United States Department of Agriculture,
Natural Resources Conservation Service
and Forest Service

In cooperation with
Michigan Department of Agriculture, Michigan Agricultural
Experiment Station, Cooperative Extension Service, and
Michigan Technological University

Soil Survey of Oceana County, Michigan

How To Use This Soil Survey

General Soil Map

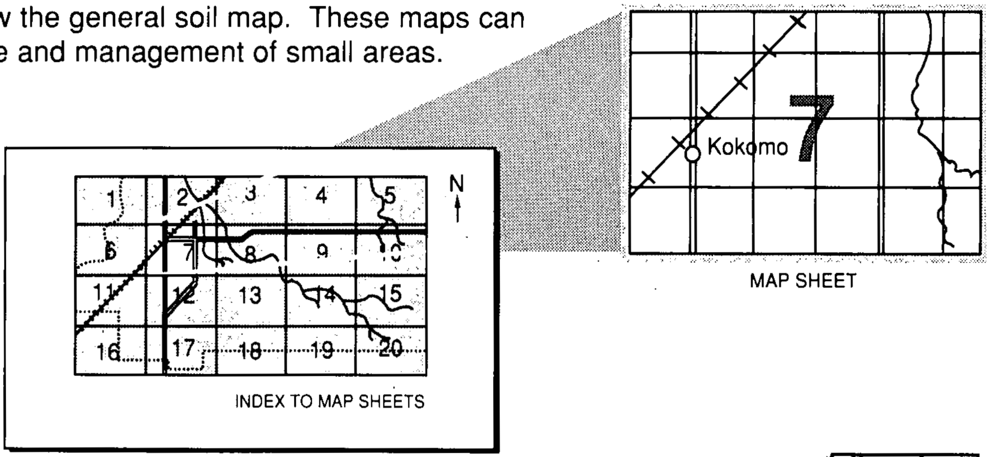
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

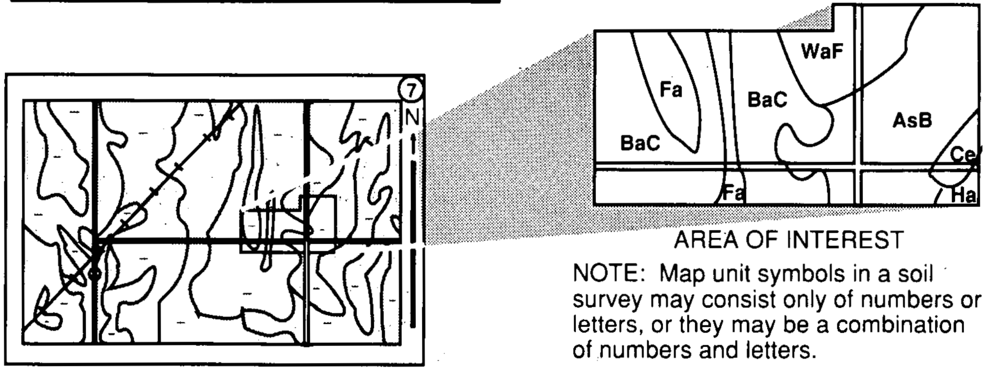
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1991. Soil names and descriptions were approved in 1992. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1991. This survey was made cooperatively by the Natural Resources Conservation Service, the Forest Service, the Michigan Department of Agriculture, the Michigan Agricultural Experiment Station, the Cooperative Extension Service, and the Michigan Technological University. The Oceana County Board of Commissioners provided financial assistance. The survey is part of the technical assistance furnished to the Oceana County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

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Cover: Windbreaks in an area of the Benona-Spinks-Grattan association.

Contents

Index to map units ... v
Summary of tables ... ix
Foreword ... xi
General nature of the county ... 1
How this survey was made ... 4
  Map unit composition ... 4
  Survey procedures ... 5
General soil map units ... 7
  Soil descriptions ... 7
  Broad land use considerations ... 14
Detailed soil map units ... 15
  Soil descriptions ... 15
Prime farmland ... 176
Use and management of the soils ... 179
  Crops and pasture ... 179
  Woodland management and productivity ... 183
  Plant associations ... 185
  Windbreaks and environmental plantings ... 187
  Recreation ... 187
  Wildlife habitat ... 188
  Engineering ... 189
Soil properties ... 195
  Engineering index properties ... 195
  Physical and chemical properties ... 196
  Soil and water features ... 197
Classification of the soils ... 201
Soil series and their morphology ... 201
  Adrian series ... 201
  Aeric Haplaquods, sandy, ortstein ... 202
  Alfic Haplorthods, sandy ... 202
  Alfic Haplorthods, sandy over loamy ... 203
  Algansee series ... 204
  Altmar series ... 204
  Alvin series ... 205
  Aquic Udipsamments ... 205
  Argic Udipsamments ... 206
  Arkona series ... 206
  Arkport series ... 207
  Benona series ... 207
  Bono series ... 208
  Capac series ... 208
  Carlisle series ... 209
  Chelsea series ... 209
  Claybanks series ... 210
  Cohoctah series ... 210
  Coloma series ... 211
  Covert series ... 211
  Del Rey series ... 211
  Dixboro series ... 212
  Entic Haplorthods, sandy ... 213
  Epworth series ... 213
  Fern series ... 214
  Freesoil series ... 214
  Glendora series ... 214
  Gowdy series ... 217
  Granby series ... 217
  Grattan series ... 218
  Houghton series ... 218
  Hoytville series ... 219
  Ithaca series ... 219
  Jebavy series ... 220
  Kerston series ... 220
  Kingsville series ... 221
  Lamson series ... 221
  Marlette series ... 221
  Martisco series ... 222
  Mollic Psammaquents ... 222
  Napoleon series ... 223
  Nappanee series ... 223
  Nordhouse series ... 224
  Okee series ... 224
  Palms series ... 225
  Perrinton series ... 225
  Pipestone series ... 225
  Plainfield series ... 226
  Remus series ... 226
  Saugatuck series ... 227
  Scalley series ... 227
  Sickles series ... 228
  Sloan series ... 228
  Spinks series ... 229
  Tekenink series ... 229

Thetford series 230
Toogood series 230
Typic Haplaquods, sandy 231
Typic Haplaquolls, sandy over loamy 231
Typic Udipsamments 231
Formation of the soils 233
Factors of soil formation 233
Processes of soil formation 234
References 237
Glossary 239
Tables 249
Interpretive groups 421

Issued April 1996

Index to Map Units

10B—Perrinton loam, 2 to 6 percent slopes......... 15
10C—Perrinton loam, 6 to 12 percent slopes 16
10D—Perrinton loam, 12 to 18 percent slopes 17
10E—Perrinton loam, 18 to 35 percent slopes 18
11A—Ithaca loam, 0 to 3 percent slopes 19
12—Bono silt loam 20
13B—Marlette fine sandy loam, 2 to 6 percent slopes.................................... 21
13C—Marlette fine sandy loam, 6 to 12 percent slopes.................................... 22
13D—Marlette fine sandy loam, 12 to 18 percent slopes.................................... 23
14B—Capac fine sandy loam, 0 to 4 percent slopes.................................... 24
16B—Remus fine sandy loam, 1 to 6 percent slopes.................................... 25
16C—Remus fine sandy loam, 6 to 12 percent slopes.................................... 26
16D—Remus fine sandy loam, 12 to 18 percent slopes.................................... 27
17B—Marlette-Fern complex, 0 to 6 percent slopes.................................... 28
17C—Marlette-Fern complex, 6 to 12 percent slopes.................................... 29
17D—Marlette-Fern complex, 12 to 18 percent slopes.................................... 31
18B—Spinks-Gowdy loamy fine sands, 0 to 6 percent slopes 32
18C—Spinks-Gowdy loamy fine sands, 6 to 12 percent slopes 33
18D—Spinks-Gowdy loamy fine sands, 12 to 18 percent slopes 35
20B—Arkport-Chelsea complex, 0 to 6 percent slopes.................................... 36
20C—Arkport-Chelsea complex, 6 to 12 percent slopes.................................... 37
20D—Arkport-Chelsea complex, 12 to 18 percent slopes.................................... 39
21A—Freesoil loamy very fine sand, 0 to 3 percent slopes 40
22B—Gowdy loamy fine sand, 1 to 6 percent slopes.................................... 41
22C—Gowdy loamy fine sand, 6 to 12 percent slopes.................................... 42
23A—Arkona loamy fine sand, 0 to 3 percent slopes.................................... 43
24—Sickles loamy sand 44
25B—Gowdy-Perrinton complex, 1 to 6 percent slopes.................................... 45
25C—Gowdy-Perrinton complex, 6 to 12 percent slopes.................................... 47
25D—Gowdy-Perrinton complex, 12 to 18 percent slopes.................................... 48
25E—Gowdy-Perrinton complex, 18 to 35 percent slopes.................................... 49
26A—Arkona-Ithaca complex, 0 to 3 percent slopes.................................... 50
27B—Arkona-Del Rey complex, 0 to 4 percent slopes.................................... 52
28B—Fern loamy fine sand, 0 to 6 percent slopes.................................... 54
28C—Fern loamy fine sand, 6 to 12 percent slopes.................................... 55
28D—Fern loamy fine sand, 12 to 18 percent slopes.................................... 56
29A—Dixboro loamy very fine sand, 0 to 3 percent slopes 57
30—Lamson muck 58
35B—Alvin-Spinks complex, 0 to 6 percent slopes.................................... 59
35C—Alvin-Spinks complex, 6 to 12 percent slopes.................................... 60
35D—Alvin-Spinks complex, 12 to 18 percent slopes.................................... 61
36A—Del Rey silt loam, 0 to 3 percent slopes 63
37A—Altmar loamy fine sand, 0 to 3 percent slopes.................................... 64
38B—Spinks-Okee complex, 0 to 6 percent slopes.................................... 65
38C—Spinks-Okee complex, 6 to 12 percent slopes.................................... 66

38D—Spinks-Okee complex, 12 to 18 percent slopes. . . . 67
38E—Spinks-Okee complex, 18 to 35 percent slopes. . . . 68
40B—Coloma-Toogood complex, 0 to 6 percent slopes. . . . 69
40C—Coloma-Toogood complex, 6 to 12 percent slopes. . . . 70
40D—Coloma-Toogood complex, 12 to 18 percent slopes 72
41—Granby mucky loamy sand, gravelly substratum 73
42B—Spinks-Remus-Fern complex, 0 to 6 percent slopes 74
42C—Spinks-Remus-Fern complex, 6 to 12 percent slopes 75
42D—Spinks-Remus-Fern complex, 12 to 18 percent slopes 76
42E—Spinks-Remus-Fern complex, 18 to 35 percent slopes 78
43B—Spinks loamy fine sand, 0 to 6 percent slopes. . . . 79
43C—Spinks loamy fine sand, 6 to 12 percent slopes. . . . 80
43D—Spinks loamy fine sand, 12 to 18 percent slopes. . . . 81
43E—Spinks loamy fine sand, 18 to 35 percent slopes. . . . 82
44B—Thetford loamy fine sand, 0 to 4 percent slopes. . . . 83
45B—Spinks-Benona complex, 0 to 6 percent slopes. . . . 84
45C—Spinks-Benona complex, 6 to 12 percent slopes. . . . 85
45D—Spinks-Benona complex, 12 to 18 percent slopes. . . . 86
45E—Spinks-Benona complex, 18 to 35 percent slopes. . . . 87
45F—Spinks-Benona complex, 35 to 70 percent slopes. . . . 88
46B—Grattan sand, dark subsoil, 0 to 6 percent slopes. . . . 89
48A—Saugatuck-Jebavy complex, 0 to 3 percent slopes. . . . 90
49B—Grattan sand, 0 to 6 percent slopes 91
49B3—Grattan sand, 0 to 6 percent slopes, severely eroded 92
49C—Grattan sand, 6 to 18 percent slopes 92
49C3—Grattan sand, 6 to 18 percent slopes, severely eroded 93
49E—Grattan sand, 18 to 35 percent slopes 94
49F—Grattan sand, 35 to 70 percent slopes 95
50B—Covert sand, 0 to 6 percent slopes 95
51B—Pipestone fine sand, 0 to 4 percent slopes. . . . 97
52—Granby sand 98
53B—Grattan sand, loamy substratum, 0 to 6 percent slopes 99
53C—Grattan sand, loamy substratum, 6 to 12 percent slopes 100
56B—Benona sand, deep banded, 0 to 6 percent slopes 100
56C—Benona sand, deep banded, 6 to 18 percent slopes 101
56E—Benona sand, deep banded, 18 to 35 percent slopes 102
57C—Nordhouse fine sand, 3 to 18 percent slopes 103
57F—Nordhouse fine sand, 18 to 75 percent slopes 104
58—Kingsville mucky sand. . . . 104
59B—Benona sand, 0 to 6 percent slopes. . . . 105
59C—Benona sand, 6 to 18 percent slopes. . . . 106
59E—Benona sand, 18 to 35 percent slopes. . . . 108
60B—Coloma sand, 0 to 6 percent slopes. . . . 109
60C—Coloma sand, 6 to 18 percent slopes. . . . 110
60E—Coloma sand, 18 to 35 percent slopes. . . . 110
61B—Epworth fine sand, 0 to 6 percent slopes 111
61C—Epworth fine sand, 6 to 18 percent slopes 112

61E—Epworth fine sand, 18 to 35 percent slopes 113
62B—Plainfield sand, 0 to 6 percent slopes 113
62C—Plainfield sand, 6 to 18 percent slopes 114
65—Sloan silt loam, frequently flooded 115
67—Cohoctah fine sandy loam, occasionally flooded 115
69—Algansee loamy fine sand, occasionally flooded 116
70—Glendora mucky loamy fine sand, frequently flooded 117
71—Houghton and Carlisle soils 117
72—Adrian muck 118
73—Palms muck 119
75—Martisco muck 120
77—Napoleon muck 120
83—Histosols and Aquents, ponded 121
84F—Dune land-Quartzipsamments-Psammaquents complex, nearly level to steep 121
85F—Udorthents-Quartzipsamments complex, very steep 122
86F—Dune land-Quartzipsamments complex, rolling to very steep 122
87—Beaches 123
88A—Udipsamments, nearly level 124
89A—Udorthents, nearly level 124
91—Pits, sand and gravel 124
92B—Chelsea fine sand, 0 to 6 percent slopes 125
92C—Chelsea fine sand, 6 to 12 percent slopes 126
96B—Spinks-Tekenink loamy fine sands, 0 to 6 percent slopes 126
96C—Spinks-Tekenink loamy fine sands, 6 to 12 percent slopes 127
96D—Spinks-Tekenink loamy fine sands, 12 to 18 percent slopes 129
96E—Spinks-Tekenink loamy fine sands, 18 to 35 percent slopes 130
97—Kerston and Carlisle mucks, frequently flooded 131
98B—Spinks-Scalley complex, 0 to 6 percent slopes 131
98C—Spinks-Scalley complex, 6 to 12 percent slopes 133
98D—Spinks-Scalley complex, 12 to 18 percent slopes 134
99B—Nappanee-Hoytville silt loams, 0 to 4 percent slopes 135
100B—Nappanee silt loam, 0 to 4 percent slopes 137
101B—Claybanks silt loam, 1 to 6 percent slopes 138
101C—Claybanks silt loam, 6 to 12 percent slopes 139
210B—Typic Udipsamments, nearly level and undulating 139
210C—Typic Udipsamments, rolling 140
210D—Typic Udipsamments, hilly 141
211B—Typic Udipsamments, banded substratum, nearly level and undulating 141
211C—Typic Udipsamments, banded substratum, rolling 142
212B—Typic Udipsamments, very deep water table, nearly level and undulating 143
213B—Argic Udipsamments, nearly level and undulating 143
213C—Argic Udipsamments, rolling 144
213D—Argic Udipsamments, hilly 144
220B—Entic Haplorthods, sandy, nearly level and undulating 145
220C—Entic Haplorthods, sandy, rolling 146
220D—Entic Haplorthods, sandy, hilly 146
220E—Entic Haplorthods, sandy, steep and very steep 147
221B—Entic Haplorthods, sandy, coarse-loamy banded substratum, nearly level and undulating 148
221C—Entic Haplorthods, sandy, coarse-loamy banded substratum, rolling 149
221D—Entic Haplorthods, sandy, coarse-loamy banded substratum, hilly 149

221E—Entic Haplorthods, sandy, coarse-loamy banded substratum, steep and very steep 150
222B—Entic Haplorthods, sandy, very deep water table, nearly level and undulating 151
222C—Entic Haplorthods, sandy, very deep water table, rolling 152
223B—Entic Haplorthods, sandy, fine-loamy banded substratum, nearly level and undulating 152
223C—Entic Haplorthods, sandy, fine-loamy banded substratum, rolling 153
223D—Entic Haplorthods, sandy, fine-loamy banded substratum, hilly 154
223E—Entic Haplorthods, sandy, fine-loamy banded substratum, steep and very steep 154
224B—Entic Haplorthods, sandy, deep water table, nearly level and undulating 155
225B—Entic Haplorthods, sandy, loamy substratum, nearly level and undulating 156
225C—Entic Haplorthods, sandy, loamy substratum, rolling.......................... 157
225D—Entic Haplorthods, sandy, loamy substratum, hilly 157
230B—Entic Haplorthods, sandy, calcareous substratum, nearly level and undulating 158
230C—Entic Haplorthods, sandy, calcareous substratum, rolling.......................... 159
230D—Entic Haplorthods, sandy, calcareous substratum, hilly 159
230E—Entic Haplorthods, sandy, calcareous substratum, steep and very steep............ 160
231B—Entic Haplorthods, sandy-Alfic Haplorthods, sandy over loamy complex, nearly level and undulating.................. 161
233B—Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, nearly level and undulating 162
233C—Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, rolling.......... 163
233D—Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, hilly............ 164
233E—Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, steep and very steep 165
235B—Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, nearly level and undulating 166
235C—Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, rolling.......... 166
240C—Entic Haplorthods, sandy, dark subsoil, rolling.................................... 167
241B—Entic Haplorthods, sandy, dark subsoil, banded substratum, nearly level and undulating................................ 168
245B—Entic Haplorthods, sandy, dark subsoil, loamy substratum, nearly level and undulating................................ 169
245C—Entic Haplorthods, sandy, dark subsoil, loamy substratum, rolling 169
245D—Entic Haplorthods, sandy, dark subsoil, loamy substratum, hilly 170
250—Mollic Psammaquents-Aquic Udipsamments-Medisaprists, euic complex, occasionally flooded........................ 171
262A—Aeric Haplaquods, sandy, ortstein, nearly level 172
263A—Aquic Udipsamments, nearly level 172
272—Typic Haplaquods, sandy.................. 173
273—Mollic Psammaquents...................... 174
274—Typic Haplaquolls, sandy over loamy 174
280—Aquents and Histosols, ponded 175
281—Medisaprists, dysic 175
282—Medisaprists, euic 176

Summary of Tables

Temperature and precipitation (table 1) 250

Freeze dates in spring and fall (table 2) 252

Growing season (table 3) 254

Acreage and proportionate extent of the soils (table 4) 255

Prime farmland (table 5) 259

Yields per acre of crops (table 6) 260

Capability classes and subclasses (table 7) 265

Woodland management and productivity (table 8) 266

Windbreaks and environmental plantings (table 9) 283

Recreational development (table 10) 290

Wildlife habitat (table 11) 306

Building site development (table 12) 318

Sanitary facilities (table 13) 334

Construction materials (table 14) 352

Water management (table 15) 367

Engineering index properties (table 16) 381

Physical and chemical properties of the soils (table 17) 399

Soil and water features (table 18) 409

Classification of the soils (table 19) 418

Foreword

This soil survey contains information that can be used in land-planning programs in Oceana County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

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Soil Survey of Oceana County, Michigan

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Fieldwork by Kelly Bishop, Joseph K. Calus, and Robert Evon, Natural Resources Conservation Service, and Thomas Bauer, Michigan Department of Agriculture

United States Department of Agriculture, Natural Resources Conservation Service and
Forest Service,
in cooperation with
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OCEANA COUNTY is in the western part of the Lower Peninsula of Michigan (fig. 1). The county borders Mason County to the north, Newaygo County to the east, Muskegon County to the south, and Lake Michigan to the west. The county has an area of 349,408 acres, or about 575 squares miles, including the Federal land in the Manistee National Forest. The county has a total water area of 3,245 acres. Hart is the county seat. It is in the northwestern part of the county. It had a population of 1,888 in 1980. About 43 percent of the county is forested, and nearly 28 percent is farmland. Farming is the main enterprise.

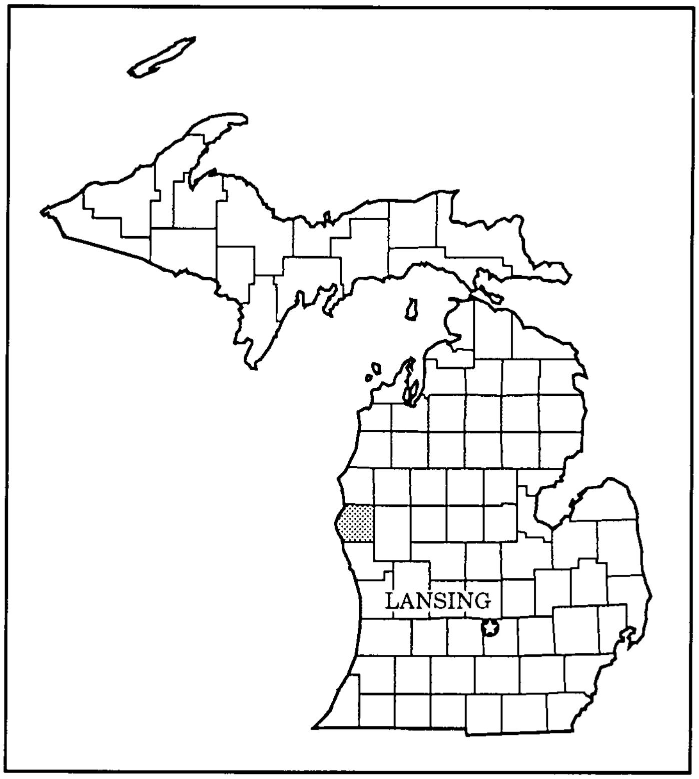

Figure 1.—Location of Oceana County in Michigan.

General Nature of the County

This section gives general information about the county. It describes history and development, climate, agriculture, industry and transportation facilities, physiography, and lakes and rivers.

History and Development

The first settlers in Oceana County arrived at the mouth of Whiskey Creek in the late 1840's, in what is now Claybanks Township. They chose the area because it was very fertile clay loam and several acres had been cleared by Indians. By the 1850's, there were 36 people living in the settlement *(14)*.

The earliest settlers included Reverend William M. Ferry and his son Thomas. Together they bought 1,300 acres of woodland along Stony Creek and opened the area's first sawmill.

Another settler was Charles Mears, who founded the present-day village of Pentwater. He built a sawmill in the mid-1850's and improved the channel between Pentwater Lake and Lake Michigan.

The official organization of Oceana County was on May 31, 1855. The first county seats were Stony Creek and Whiskey Creek. In 1864, the county seat was moved to Hart. An influx of new settlers and lumbermen increased the county's population from 7,000 in 1870 to 12,000 in 1880.

The best timber had been cut by the 1880's, and the residents by that time began growing orchards. In the early 1860's, apple and peach trees were planted near Little Point Sable. In 1867, peaches, plums, and pears were brought to Pentwater, marketed, and shipped to Chicago.

Oceana County is one of Michigan's leading horticultural producers. It ranks first in the State in the production of pears, second in the production of plums, and third in the production of peaches. The county is the site of the National Asparagus Festival.

Climate

Prepared by the Michigan Department of Agriculture, Environmental Division, East Lansing, Michigan.

The major climatic variations in the county, even among areas that are near one another, are mainly the result of differences in topography and the proximity to Lake Michigan. Data from three stations were used to show those variations. Table 1 gives data on temperature and precipitation for the survey area as recorded in the period 1951 to 1980 at Hart and Hesperia in Oceana County and at Montague in Muskegon County. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 24.7 degrees F at Hart, 22.9 degrees at Hesperia, and 25.5 degrees at Montague. The average daily minimum temperatures are 17.4 degrees at Hart, 14.6 degrees at Hesperia, and 17.8 degrees at Montague. The lowest temperature on record was -35 degrees, at Hart on February 11, 1899, and at Montague on January 31, 1951. In summer the average temperatures are 67.8 degrees at Hart, 67.2 degrees at Hesperia, and 66.7 degrees at Montague. The average daily maximum temperatures are 79.3 degrees at Hart, 80.1 degrees at Hesperia, and 78.7 degrees at Montague. The highest recorded temperatures were 104 degrees at Hart on July 13, 1936; 100 degrees at Hesperia on August 21, 1955; and 98 degrees at Montague on June 17, 1957.

Growing degree days are shown in table 1 They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total average annual precipitation is 34.36 inches at Hart, 33.57 inches at Hesperia, and 33.55 inches at Montague. Of the total precipitation, an average of about 18.70 inches, or about 55 percent, usually falls in April through September at the three locations. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14.94 inches. The heaviest 1-day rainfalls during the period of record were 5.43 inches at Hart, 6.56 inches at Hesperia, and 5.54 inches at Montague, all on September 11, 1986. Thunderstorms occur on about 36 days each year, and most occur in June, July, or August.

The average annual seasonal snowfall is 98.8 inches at Hart, 75.5 inches at Hesperia, and 89.5 inches at Montague. The greatest snow depths at any one time during the period of record were 65 inches at Hart, 30 inches at Hesperia, and 31 inches at Montague. On the average, 98 days of the year at Hart, 97 days of the year at Hesperia, and 88 days of the year at Montague have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The heaviest 1-day snowfalls on record were 18.5 inches at Hart, 11 inches at Hesperia, and 15.1 inches at Montague. The greatest monthly snowfalls were 69.8 inches at Hart in December 1963, 48.1 inches at Hesperia in January 1979, and 64.5 inches at Montague in January 1977. The greatest seasonal total snowfalls were 144.3 inches at Hart during the 1977-78 season, 120 inches at Hesperia during the 1964-65 season, and 158.7 inches at Montague during the 1964-65 season. The least seasonal total snowfalls were 29.8 inches at Hart during the 1931-32 season, 30.1 inches at Hesperia during the 1948-49 season, and 26.5 inches at Montague during the 1905-6 season.

The average relative humidity in midafternnon is about 64 percent at Montague. Humidity is higher at night, and the average at dawn is about 81 percent. Based on data recorded in Grand Rapids, the sun shines 62 percent of the time possible in summer and 30 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 12.5 miles per hour, in January.

Agriculture

A variety of soils and relief in Oceana County and the moderating effects of Lake Michigan on the climate have resulted in a variety of agricultural products. About 96,926 acres in the county, or nearly 28 percent of the total land area, is farmland. In 1988, such crops as corn, wheat, and oats were grown on about 12,970 acres *(10)*. About 17,700 acres was used for vegetables. Oceana County leads the State in the production of asparagus, the county's most common vegetable crop. This crop is grown mainly on coarse textured, excessively drained soils. Other vegetables, such as cucumbers and squash, generally are grown on coarse textured to medium textured, well drained soils.

Tart and sweet cherries, apples, peaches, pears, prunes, and plums are the major fruits grown in the county. They are generally grown in the higher areas, where frost damage is minimized. Many of the fruit-producing areas are in the western half of the county, which tends to be more frost-free than the eastern half. These areas are near Lake Michigan. The production of fruit-tree nursery stock and Christmas tree plantations are important enterprises in the county.

Some of the farmland in the county is used for livestock enterprises and hay crops. The livestock are mainly hogs, beef cattle, and dairy cows. Alfalfa is the primary hay crop.

Industry and Transportation Facilities

The main industry in Oceana County is farming. Specialty crops are marketed fresh, frozen, or canned. The other main industries are tourism; the production of lumber for pallets, crates, and baskets; and machine tooling and casting.

The main highway in the county is U.S. Route 31, which runs north and south through the western half of the county. The major State roadways are Route 20, which runs east and west through the south-central part of the county, and Route 120, which runs along the Newaygo County line to Hesperia. The frequently traveled county roads include Oceana Drive and Polk Road.

Physiography

The bedrock beneath Oceana County is covered by a thick layer of glacial deposits, which formed through the complex action of the Lake Michigan Lobe of the Wisconsin glacial ice sheet. Glacial action resulted in five dominant features—moraines, till plains, lake plains, outwash plains, and drainageways. Other geological features in the county are sand dunes and beach ridges.

The thickness of the glacial drift (unconsolidated sediment) over bedrock ranges from 600 feet in the northern part of the county to 200 feet in the southern part *(4)*. The bedrock is sedimentary and has been downwarped toward the center of the State to form the edge of a huge bowllike structure called the Michigan basin. This bedrock formed during the Mississippian Period. It consists of the Coldwater shale formation in the western part of the county, the Napoleon-Marshall sandstone formation in the central part, and the Michigan gypsum formation in the eastern part *(5)*.

Part of a major moraine is in the county. The Port Huron moraine is a large morainic system that extends around the State roughly parallel with the coast. Within the county, it generally extends in a northeasterly direction from the area of New Era to east of Crystal Valley. The dominant features of the moraine are three distinct ridges that reach the highest elevations in the county. The ridges are dissected by outwash channels.

The till plains are on the eastern and western sides of the end moraine. The largest till plain is in Walkerville Township. Other areas of till are in Weare, Hart, and Claybanks Townships.

The major areas of lake plains are directly east of the sand dunes in the county. The lake plains include a small area around Stoney Lake, in Benoa Township, and a larger area extending from the Silver Lake area north to the Mason County line *(24)*. An area near the southeast corner of the county was part of a glacial lake.

The outwash plains are mainly in the south-central and southeastern parts of the county. The largest outwash area is in the eastern part of Otto Township and the western part of Greenwood Township. Other areas of outwash are smaller and are mainly on the eastern sides of moraines.

The major drainageways are those along the North and South Branches of the Pentwater River in the northern part of the county, Stoney Creek in the southwestern part, and the South and North Branches of the White River in the southeastern part.

Lakes and Rivers

Oceana County has about 65 lakes and 4 major rivers. The largest lakes are Silver Lake (690 acres), Pentwater Lake (430 acres), Stony Lake (278 acres), McLaren Lake (271 acres), and Hart Lake (240 acres). Bodies of water that are more than 40 acres in size make up a total of about 3,245 acres in the county.

The major rivers are the North and South Branches of the Pentwater River and the North and South Branches of the White River. The North Branch of the Pentwater River flows in a southwest direction through Weare Township and into Pentwater Lake. The South Branch of the Pentwater River flows in a northwest direction through Elbridge and Hart Townships and into the North Branch of the Pentwater River. The North

Branch of the White River flows in a south-southwest direction through Newfield, Ferry, and Otto Townships and into the South Branch of the White River. The South Branch of the White River flows in a southwest direction from Hesperia through Greenwood Township and into Muskegon County.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; and the kinds of crops and native plants growing on the soils. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

Survey Procedures

The general procedures followed in making this survey are described in the National Soils Handbook *(20)* of the Natural Resources Conservation Service. The Huron-Manistee National Forest Ecological Classification System *(8, 9, 11, 13, 15, 21)* was used in conjunction with the handbook on most of the Forest Service lands and on some private tracts within the Manistee National Forest administrative boundary. The design of the map units in these areas differs from that of the units in other parts of the county.

The Ecological Classification System includes evaluation and classification of landscape areas by ecological approaches. Areas of ecological units are mapped on aerial photographs, and inventory maps are used to make interpretations for forest land and resource management.

Procedures for Map Units 10B to 101C

The soil survey maps made for conservation planning prior to the start of the project and for the survey of the county published in 1938 *(17)* were among the references used. Before the actual fieldwork began, preliminary boundaries of slopes and landforms were plotted stereoscopically on 1:15,840 leaf-off aerial photography. U.S. Geologic Survey topographic maps, at a scale of 1:24,000, helped the soil scientists to relate land and image features.

A reconnaissance was made by vehicle before the soil scientist traversed the surface on foot, examining the soils. In areas where the soil pattern is complex, traverses and random observations were spaced as close as 200 yards. In areas where the soil pattern is relatively simple, traverses were about 0.25 mile apart.

As they traversed the surface, the soil scientists divided the landscape into segments. For example, a hillside would be separated from a swale or a gently sloping ridgetop from a very steep side slope.

Observations of such items as landforms, blown-down trees, vegetation, and roadbanks were made without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. The soil material was examined with the aid of a hand auger or a spade to a depth of about 5 feet. The pedons described as typical were observed and studied in pits that were dug with shovels, mattocks, and digging bars.

Notes were taken on the composition of map units during each year of the project. These notes were supplemented with information provided by transects and additional investigations as mapping progressed and the composition of individual map units was determined for the survey area.

Samples for chemical and physical analyses were taken from representative sites of some soils in the survey area. The analyses were made by the Soil Research Laboratory, Michigan Technological University, Houghton, Michigan, and the Soil Survey Laboratory, Lincoln, Nebraska. The results of the studies can be obtained on request from the two laboratories or from the State Office of the Natural Resources Conservation Service at East Lansing, Michigan.

After completion of the soil mapping on aerial photographs, map unit delineations were transferred by hand to another set of the same photographs. Cultural features were recorded from observations of the maps and the landscape.

Procedures for Map Units 210B to 282

Prior to ecological unit mapping, information on the climate, geology, soils, hydrology, and vegetation was collected in the survey area. Research techniques were used in mid-to-late successional stands to collect information on vegetative and soil components in areas on uplands. Samples were not collected in early successional aspen stands, young stands, plantations, or stands disturbed by recent harvesting or fires. The results were used to develop the ecological map units, which are defined on the basis of both abiotic landscape characteristics (generally stable characteristics, such as climate and landforms) and biotic landscape characteristics (generally unstable characteristics, such as vegetation).

A premapping reconnaissance was conducted in the survey area before actual field inventory began. Important results of the reconnaissance activities were a listing of the ecological units expected to be mapped in the area, definition of features differentiating the units, and a set of specific sites in the Manistee National Forest where detailed data were collected for quality-control analysis in a laboratory.

Following reconnaissance, the mapping personnel traversed the landscape, evaluated the components of the current ecosystems, determined and observed ecological unit boundaries in the field, and delineated preliminary map units on aerial photographs. During field mapping, stereo images, photo-tones, and photo colors were used to delineate landscape features on the aerial photographs. Some important characteristics used by the field personnel to evaluate an area included water table levels, soil texture and color, drainage systems, geologic indicators, and interpretation of groups of vegetative species.

Mappers typically inventoried 300 to 400 acres per day. They performed detailed evaluations and completed note cards on 10 to 15 specific sites. These sites were strategically identified for their landscape features and as points for the collection of data on overstory, understory, ground flora, forest floor, soil, substratum, and ground water for keying ecological units. Sandy soils were described to a depth of 15 feet. Textural bands at the sites have been shown to have a significant influence on tree growth and species composition *(6)*. As a result, the presence, absence, and intensity of deep textural bands were recorded as part of the sampling and inventory scheme. These data are a permanent part of the forest records available at the office of the supervisor of the Huron-Manistee National Forest.

Following field inventory, the final ecological unit boundaries were drawn onto the aerial photographs. The completed photography was checked for line closure and matching of delineations across photographs.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some of the names and descriptions of the soils on the general soil map of Oceana County do not match those on the maps of adjacent counties, mainly because of variations in the extent of the soils in the counties.

Soil Descriptions

Areas of Nearly Level to Very Steep, Moderately Well Drained to Excessively Drained Soils and Areas of Dune Land

These areas are used as woodland. The erosion hazard, an equipment limitation, and seedling mortality are the major management concerns. The major soils are generally unsuited to cropland and are poorly suited or unsuited to pasture. Droughtiness is the major management concern.

1. Epworth-Dune Land-Nordhouse Association

Dune land and nearly level to very steep, well drained and excessively drained, sandy soils on dunes, lake plains, and beach ridges

Epworth soils are on broad plains, knolls, foot slopes, back slopes, and shoulder slopes on lake plains and beach ridges. Dune land is on knolls, back slopes, shoulder slopes, and ridgetops. Nordhouse soils are on knolls, foot slopes, back slopes, shoulder slopes, and ridgetops on dunes. Slope ranges from 0 to 75 percent.

This association makes up about 3 percent of the county. It is about 30 percent Epworth and similar soils, 20 percent Dune land, 15 percent Nordhouse and similar soils, and 35 percent soils of minor extent.

The Epworth soils are well drained. Typically, the surface layer is black fine sand about 1 inch thick. The subsurface layer is grayish brown fine sand about 2 inches thick. The subsoil is dark brown and strong brown, loose fine sand about 21 inches thick. The substratum to a depth of 60 inches is yellowish brown and brownish yellowish fine sand.

The Nordhouse soils are excessively drained. Typically, the surface layer is black fine sand about 1 inch thick. The subsurface layer is light brownish gray fine sand about 7 inches thick. The subsoil is strong brown and brownish yellow, loose fine sand. The substratum to a depth of 60 inches is very pale brown fine sand.

The common minor soils in this association are the poorly drained Psammaquents and very poorly drained Histosols and Aquents in low areas and areas of beaches and the somewhat poorly drained Pipestone soils in drainageways.

Most areas of this association are wooded. An equipment limitation and seedling mortality are the major management concerns. The erosion hazard also is a management concern in the hilly to very steep areas.

2. Typic Udipsamments-Entic Haplorthods, Sandy Association

Nearly level to steep, moderately well drained to excessively drained, sandy soils on outwash plains, ground moraines, and end moraines

Typic Udipsamments are on broad plains, knolls, ridges, back slopes, and shoulder slopes. Entic Haplorthods are on broad plains, knolls, back slopes, shoulder slopes, and ridgetops. Slope ranges from 0 to 60 percent.

This association makes up about 3 percent of the county. It is about 57 percent Typic Udipsamments and similar soils, 25 percent Entic Haplorthods and similar soils, and 18 percent soils of minor extent.

The Typic Udipsamments are excessively drained. Typically, about 1 inch of leaf litter covers the surface. The surface layer is very dark gray sand about 2 inches thick. The subsoil is yellowish brown and brownish yellow, loose sand about 33 inches thick. The substratum to a depth of 99 inches is very pale brown sand.

The Entic Haplorthods are moderately well drained to excessively drained. Typically, about 1 inch of leaf litter covers the surface. The surface layer is very dark gray sand about 2 inches thick. The subsurface layer is light gray sand about 1 inch thick. The subsoil is dark brown, strong brown, and yellowish brown, loose sand about 44 inches thick. The substratum to a depth of 99 inches is pale brown and light yellowish brown sand.

The common minor soils in this association are the very poorly drained Typic Haplaquods, sandy, and Medisaprists, euic, in low areas and depressions and the moderately well drained Aquic Udipsamments on low knolls.

This association is wooded. An equipment limitation and seedling mortality are the major management concerns. The erosion hazard also is a management concern in the hilly and steep areas.

Nearly Level to Very Steep, Excessively Drained, Moderately Well Drained, and Poorly Drained Soils

These areas are used as woodland. The erosion hazard, an equipment limitation, the hazard of windthrow, and seedling mortality are the major management concerns. Some of the soils are suitable as cropland. If cultivated crops are grown, the major management concerns are soil blowing, water erosion, seasonal droughtiness, and seasonal wetness.

3. Plainfield-Coloma-Grattan Association

Nearly level to very steep, excessively drained, sandy soils on outwash plains, lake plains, ground moraines, and end moraines

Plainfield soils are on broad plains, knolls, and foot slopes on outwash plains. Coloma soils are on broad plains, knolls, back slopes, and shoulder slopes on outwash plains and moraines. Grattan soils are on broad plains, knolls, back slopes, shoulder slopes, and ridgetops on outwash plains, lake plains, and moraines. Slope ranges from 0 to 70 percent.

This association makes up about 8 percent of the county. It is about 30 percent Plainfield and similar soils, 28 percent Coloma and similar soils, 14 percent Grattan and similar soils, and 28 percent soils of minor extent.

Typically, the surface layer of the Plainfield soils is black sand about 3 inches thick. The subsoil is dark brown and strong brown, loose sand about 27 inches thick. The substratum to a depth of 60 inches is light yellowish brown sand.

Typically, the surface layer of the Coloma soils is very dark grayish brown sand about 4 inches thick. The subsoil is about 80 inches thick. The upper part is yellowish brown and brownish yellow, loose sand, and the lower part is light yellowish brown, loose sand that has lamellae of dark brown, loose loamy sand.

Typically, the surface layer of the Grattan soils is very dark gray sand about 3 inches thick. The subsurface layer is grayish brown sand about 3 inches thick. The subsoil is dark brown and dark yellowish brown, loose sand about 26 inches thick. The substratum to a depth of 60 inches is light yellowish brown sand.

The common minor soils in this association are the poorly drained Granby and very poorly drained Houghton, Carlisle, and Napoleon soils in depressions and on outwash plains; the very poorly drained Glendora soils on flood plains; and the moderately well drained Covert soils on low knolls.

Most areas of this association are wooded. An equipment limitation and seedling mortality are the major management concerns. The erosion hazard also is a management concern in the hilly to very steep areas.

4. Grattan-Covert-Granby Association

Nearly level to rolling, excessively drained, moderately well drained, and poorly drained, sandy soils on lake plains and outwash plains

Grattan soils are on broad plains, knolls, foot slopes, and back slopes. Covert soils are on broad plains and low knolls. Granby soils are in depressions. Slope ranges from 0 to 18 percent.

This association makes up about 15 percent of the county. It is about 35 percent Grattan and similar soils, 25 percent Covert and similar soils, 15 percent Granby and similar soils, and 25 percent soils of minor extent.

The Grattan soils are excessively drained. Typically, the surface layer is very dark gray sand about 3 inches thick. The subsurface layer is grayish brown sand about 3 inches thick. The subsoil is dark brown and dark yellowish brown, loose sand about 26 inches thick. The substratum to a depth of 60 inches is light yellowish brown sand.

The Covert soils are moderately well drained.

Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is grayish brown sand about 3 inches thick. The subsoil is loose sand about 29 inches thick. The upper part is dark brown and strong brown, and the lower part is brownish yellow and mottled. The substratum to a depth of 60 inches is sand. It is pale brown and mottled in the upper part and brown in the lower part.

The Granby soils are poorly drained. Typically, the surface layer is black sand about 11 inches thick. The subsoil is light brownish gray, loose sand about 17 inches thick. The substratum to a depth of 60 inches is grayish brown sand.

The common minor soils in this association are the very poorly drained Houghton and Carlisle and poorly drained Jebavy and Sickles soils in landscape positions similar to those of the Granby soils, the somewhat poorly drained Pipestone and Saugatuck soils in drainageways and on foot slopes, and the excessively drained Benona soils in landscape positions similar to those of the Grattan soils.

Most areas of this association are used as woodland. An equipment limitation, seedling mortality, and the hazard of windthrow are the main concerns in managing woodland. The soils are poorly suited to cropland because of soil blowing, seasonal droughtiness, and seasonal wetness.

Nearly Level to Very Steep, Excessively Drained and Well Drained Soils

These soils are suited to cropland and orchards. Water erosion, a low content of organic matter, a limited available water capacity, seasonal droughtiness, seasonal wetness, and the slope are the major management concerns. If the soils are used as woodland, an equipment limitation and seedling mortality are the major management concerns. The erosion hazard also is a management concern in the rolling to very steep areas.

5. Benona-Spinks-Grattan Association

Nearly level to very steep, excessively drained and well drained, sandy soils on ground moraines, end moraines, lake plains, and outwash plains

Benona soils are on broad plains, knolls, back slopes, shoulder slopes, and hillsides. Spinks soils are on broad plains, knolls, back slopes, and shoulder slopes. Grattan soils are on broad plains, back slopes, shoulder slopes, and ridgetops. Slope ranges from 0 to 70 percent.

This association makes up about 43 percent of the county. It is about 35 percent Benona and similar soils, 20 percent Spinks and similar soils, 15 percent Grattan and similar soils, and 30 percent soils of minor extent (fig. 2).

The Benona soils are excessively drained. Typically, the surface layer is dark brown sand about 8 inches thick. The subsoil is about 52 inches thick. The upper part is dark brown, very friable sand; the next part is strong brown and dark yellowish brown, loose sand; and the lower part is pale brown, loose sand that has lamellae of strong brown, very friable loamy sand.

The Spinks soils are well drained. Typically, the surface layer is very dark grayish brown loamy fine sand about 9 inches thick. The subsoil is about 51 inches thick. The upper part is strong brown, very friable fine sand; the next part is brown, loose fine sand; and the lower part is pale brown, loose sand that has lamellae of dark brown, friable loamy sand.

The Grattan soils are excessively drained. Typically, the surface layer is very dark gray sand about 3 inches thick. The subsurface layer is grayish brown sand about 3 inches thick. The subsoil is dark brown and dark yellowish brown, loose sand about 26 inches thick. The substratum to a depth of 60 inches is light yellowish brown sand.

The common minor soils in this association are the very poorly drained Lamson and Houghton and poorly drained Granby soils in depressions, the moderately well drained Covert soils on low knolls, the somewhat poorly drained Thetford soils in drainageways and on foot slopes, and the well drained Tekenink and Scalley soils in landscape positions similar to those of the major soils.

In most areas this association is fairly well suited to cropland. Soil blowing, seasonal droughtiness, a low content of organic matter, and a limited available water capacity are the major management concerns. Water erosion also is a management concern in the gently rolling and rolling areas.

If these soils are used as woodland, an equipment limitation and seedling mortality are the major management concerns. The erosion hazard also is a management concern in the rolling to very steep areas.

6. Spinks-Remus-Fern Association

Nearly level to steep, well drained, loamy and sandy soils on ground moraines, end moraines, and outwash plains

Spinks soils are on broad plains, knolls, back slopes, and shoulder slopes. Remus soils are on broad plains, knolls, and back slopes. Fern soils are on broad plains and low knolls. Slope ranges from 0 to 35 percent.

This association makes up about 12 percent of the

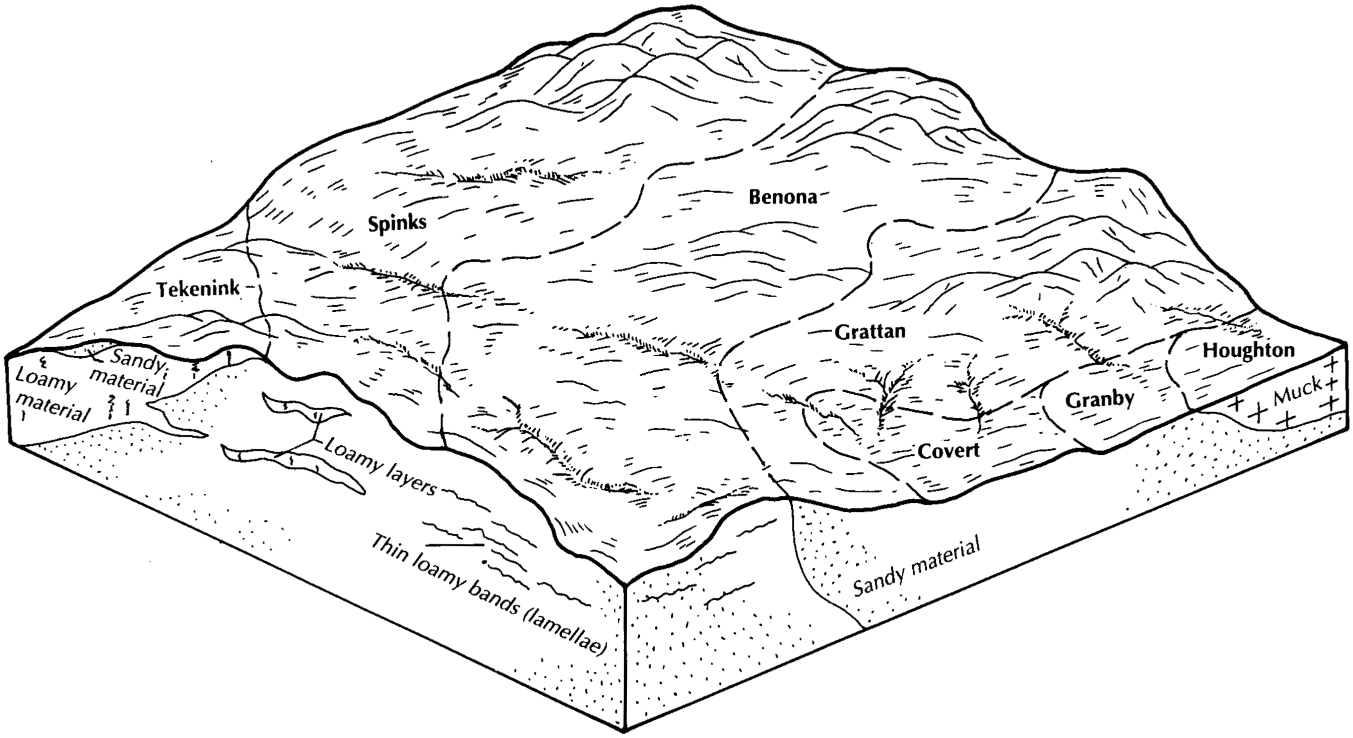

Figure 2.—Typical pattern of soils and underlying material in the Benona-Spinks-Grattan association.

county. It is about 35 percent Spinks and similar soils, 20 percent Remus and similar soils, 15 percent Fern and similar soils, and 30 percent soils of minor extent (fig. 3).

Typically, the surface layer of the Spinks soils is very dark grayish brown loamy fine sand about 9 inches thick. The subsoil is about 51 inches thick. The upper part is strong brown, very friable fine sand; the next part is brown, loose fine sand; and the lower part is pale brown, loose sand that has lamellae of dark brown, friable loamy sand.

Typically, the surface layer of the Remus soils is very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 41 inches thick. The upper part is pale brown loamy sand and dark brown, friable loam, and the lower part is dark reddish brown and brown, firm loam and sandy clay loam. The substratum to a depth of 60 inches is brown sandy clay loam.

Typically, the surface layer of the Fern soils is dark brown loamy fine sand about 10 inches thick. The subsoil is about 50 inches thick. In sequence downward, it is brown, very friable loamy fine sand; pale brown loamy fine sand and dark brown, friable loam; reddish brown, firm clay loam and pale brown loamy sand; and dark brown, friable loam.

The common minor soils in this association are the moderately well drained Covert soils on low knolls, the poorly drained Granby and very poorly drained Houghton soils in depressions, the somewhat poorly drained Freesoil soils in drainageways and on foot slopes, and the well drained Tekenink soils in landscape positions similar to those of the major soils.

In most areas this association is fairly well suited to cropland. Soil blowing, seasonal droughtiness, a low content of organic matter, and a limited available water capacity are the major management concerns. Water erosion and the slope also are management concerns in the gently rolling to hilly areas.

If these soils are used as woodland, an equipment limitation and seedling mortality are the major management concerns. The erosion hazard also is a management concern in the hilly and steep areas.

7. Entic Haplorthods, Sandy-Alfic Haplorthods, Sandy Association

Nearly level to very steep, excessively drained and well drained, sandy soils on ground moraines and end moraines

Entic Haplorthods are on broad plains, knolls, back slopes, shoulder slopes, and ridgetops. Alfic Haplorthods are on broad plains, knolls, back slopes, and shoulder slopes. Slope ranges from 0 to 60 percent.

This association makes up about 5 percent of the county. It is about 40 percent Entic Haplorthods and similar soils, 35 percent Alfic Haplorthods and similar soils, and 25 percent soils of minor extent.

The Entic Haplorthods are excessively drained. Typically, about 1 inch of leaf litter covers the surface. The surface layer is very dark gray sand about 2 inches thick. The subsurface layer is light gray sand about 1 inch thick. The subsoil is dark brown, strong brown, and yellowish brown, loose sand about 44 inches thick. The substratum to a depth to 99 inches is pale brown and light yellowish brown sand.

The Alfic Haplorthods are well drained. Typically, about 2 inches of black, decomposed leaf litter covers the surface. The surface layer is very dark grayish brown loamy sand about 2 inches thick. The subsurface layer is light gray sand about 2 inches thick. The subsoil is about 38 inches thick. The upper part is dark yellowish brown, yellowish brown, and brownish yellow, loose sand, and the lower part is dark brown, friable sandy loam. The substratum to a depth of 99 inches is light yellowish brown and yellowish brown sand.

The common minor soils in this association are the poorly drained Typic Haplaquolls, sandy over loamy, and very poorly drained Medisaprists, euic, in depressions; the somewhat poorly drained Aeric Haplaquods, sandy, ortstein, in drainageways and on foot slopes; and the excessively drained Typic Udipsamments in landscape positions similar to those of the major soils.

This association is wooded. An equipment limitation and seedling mortality are the major management concerns. The erosion hazard also is a management concern in the hilly to very steep areas.

Nearly Level to Steep, Well Drained, Somewhat Poorly Drained, and Very Poorly Drained Soils

These soils are used as cropland. Soil blowing, water erosion, seasonal wetness, tilth in the surface layer, compaction, and the slope are the major management concerns. If the soils are used as woodland, an equipment limitation, the hazard of windthrow, and seedling mortality are the major management concerns.

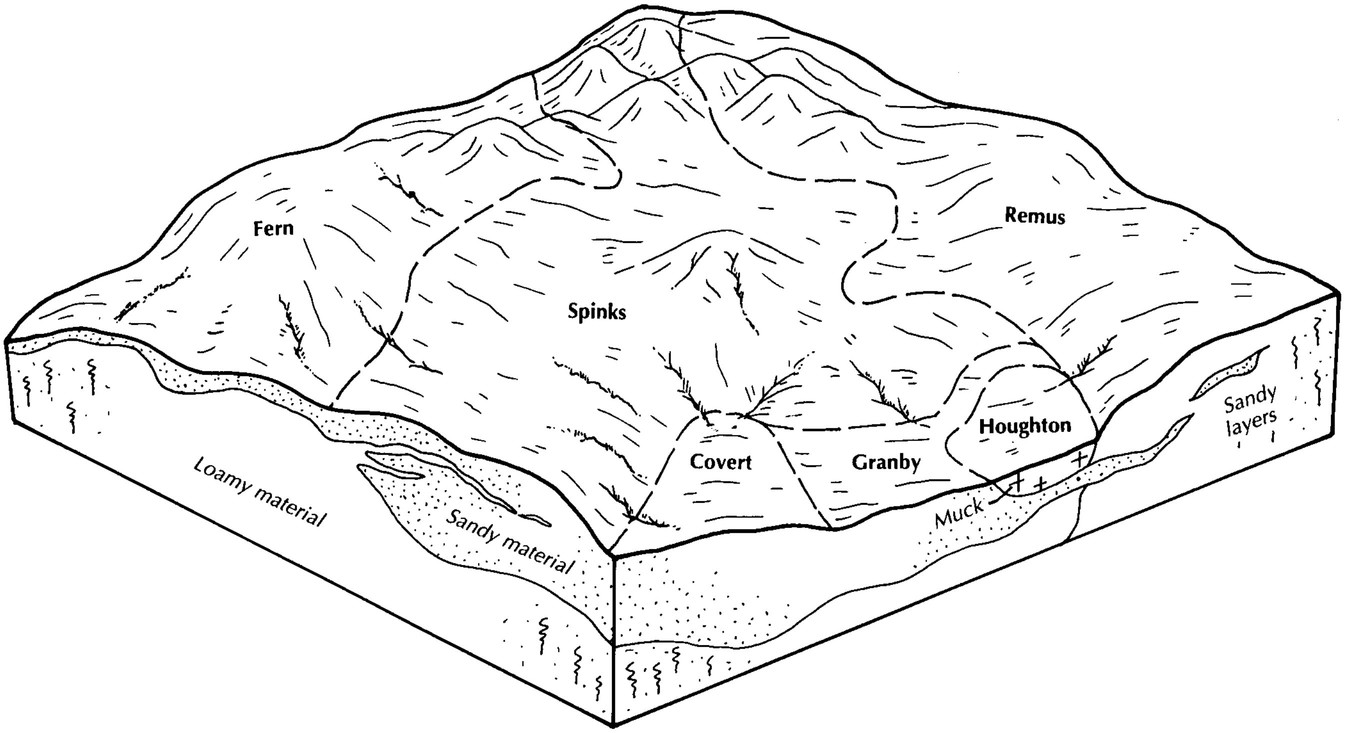

Figure 3.—Typical pattern of soils and underlying material in the Spinks-Remus-Fern association.

8. Claybanks-Nappanee-Hoytville Association

Nearly level to rolling, well drained, somewhat poorly drained, and very poorly drained, loamy soils on ground moraines

Claybanks soils are on broad plains and knolls. Nappanee soils are on broad plains and low knolls. Hoytville soils are in depressions. Slope ranges from 0 to 12 percent.

This association makes up about 1 percent of the county. It is about 30 percent Claybanks and similar soils, 25 percent Nappanee and similar soils, 13 percent Hoytville and similar soils, and 32 percent soils of minor extent.

The Claybanks soils are well drained. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is about 4 inches of light brownish gray silt loam and reddish brown, firm silty clay. The subsoil to a depth of 60 inches is reddish brown, brown, and pale brown, mottled, firm clay.

The Nappanee soils are somewhat poorly drained. Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsoil is about 51 inches thick. The upper part is dark yellowish brown, mottled, firm silty clay and clay, and the lower part is brown, mottled silty clay.

The Hoytville soils are very poorly drained. Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsoil is about 51 inches thick. The upper part is dark gray and greenish gray, mottled, firm silty clay, and the lower part is gray, mottled silty clay and clay.

The common minor soils in this association are the sandy, well drained Gowdy soils in landscape positions similar to those of the Claybanks soils; the frequently flooded, very poorly drained Sloan soils on flood plains; and the sandy, somewhat poorly drained Arkona soils in landscape positions similar to those of the Nappanee soils.

In most areas this association is fairly well suited to cropland. Water erosion, seasonal wetness, compaction, and tilth in the surface layer are the major management concerns.

If these soils are used as woodland, an equipment limitation, the hazard of windthrow, and seedling mortality are the major management concerns.

9. Perrinton-Gowdy-Ithaca Association

Nearly level to steep, well drained and somewhat poorly drained, loamy and sandy soils on ground moraines and end moraines

Perrinton and Gowdy soils are on broad plains, knolls, back slopes, and shoulder slopes. Ithaca soils are on foot slopes and low flats. Slope ranges from 0 to 35 percent.

This association makes up about 6 percent of the county. It is about 39 percent Perrinton and similar soils, 15 percent Gowdy and similar soils, 11 percent Ithaca and similar soils, and 35 percent soils of minor extent (fig. 4).

The Perrinton soils are well drained. Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 26 inches thick. The upper part is grayish brown fine sandy loam and dark brown, mottled, firm silty clay loam, and the lower part is dark brown silty clay loam and strong brown, firm silty clay. The substratum to a depth of 60 inches is dark brown and yellowish brown silty clay.

The Gowdy soils are well drained. Typically, the surface layer is dark brown loamy fine sand about 9 inches thick. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, loose fine sand; the next part is dark brown, firm silty clay loam and pale brown fine sandy loam; and the lower part is strong brown, firm silty clay loam. The substratum to a depth of 60 inches is strong brown silty clay loam.

The Ithaca soils are somewhat poorly drained. Typically, the surface layer is very dark gray loam about 9 inches thick. The subsoil is about 51 inches thick. The upper part is pale brown, firm fine sandy loam and dark brown clay loam; the next part is dark brown and dark yellowish brown, mottled, firm clay loam; and the lower part is brown, mottled, firm clay loam.

The common minor soils in this association are the well drained, sandy Spinks soils in landscape positions similar to those of the Perrinton soils; the very poorly drained Bono soils in depressions; and the somewhat poorly drained, sandy Arkona soils in landscape positions similar to those of the Ithaca soils.

In most areas this association is fairly well suited to cropland. Soil blowing, water erosion, seasonal wetness, seasonal droughtiness, tilth in the surface layer, and compaction are the major management concerns.

If these soils are used as woodland, the erosion hazard and an equipment limitation are the major management concerns in the hilly and steep areas. An equipment limitation caused by wetness is a management concern in areas of the Ithaca soils.

Nearly Level, Very Poorly Drained and Poorly Drained Soils

These soils are used as woodland. An equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns.

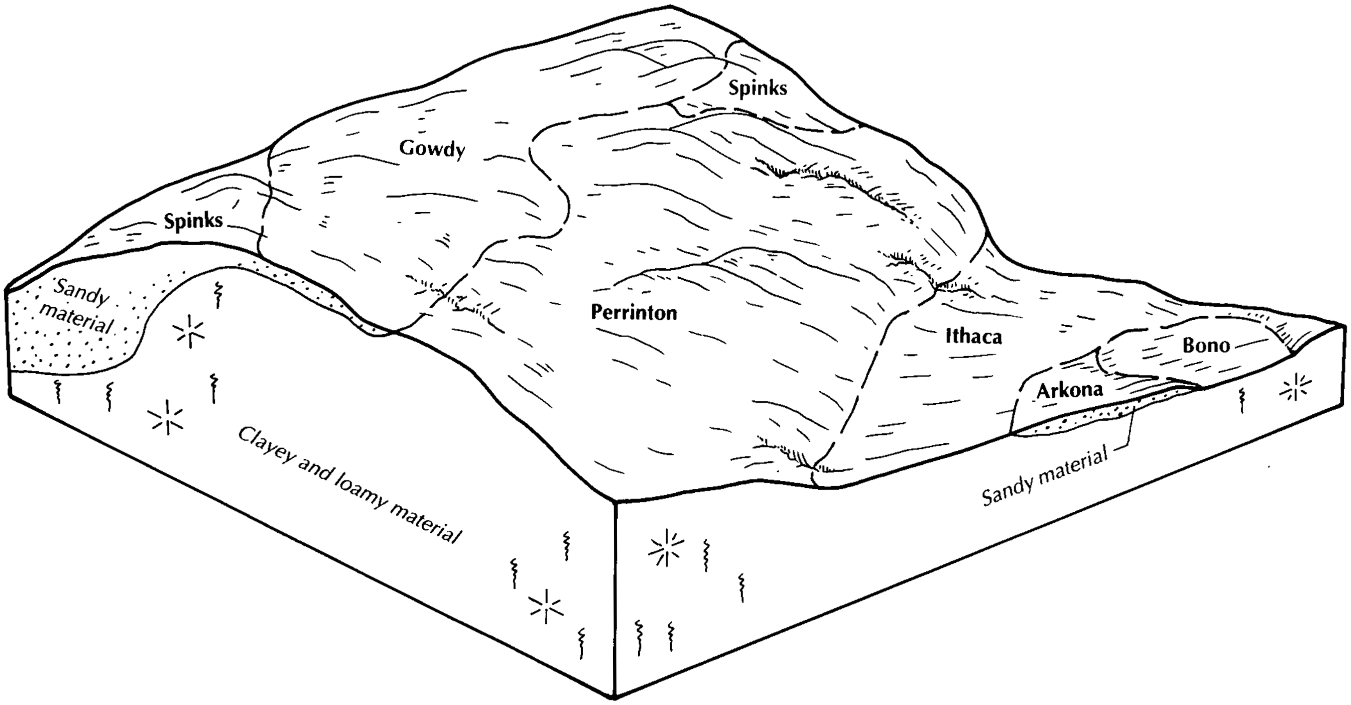

Figure 4.—Typical pattern of soils and underlying material in the Perrinton-Gowdy-Ithaca association.

10. Houghton-Kerston-Carlisle Association

Nearly level, very poorly drained, mucky soils on flood plains, ground moraines, outwash plains, and lake plains

Houghton soils are in depressions on ground moraines, lake plains, and outwash plains. Kerston soils are in depressions on flood plains. Carlisle soils are in depressions on flood plains, ground moraines, and outwash plains. Slope ranges from 0 to 2 percent.

This association makes up about 2 percent of the county. It is about 40 percent Houghton and similar soils, 25 percent Kerston and similar soils, 15 percent Carlisle and similar soils, and 20 percent soils of minor extent.

Typically, the surface layer of the Houghton soils is very dark brown mucky peat about 8 inches thick. The subsoil is black, friable muck about 52 inches thick.

Typically, the surface layer of the Kerston soils is black muck about 13 inches thick. The subsoil is about 20 inches thick. The upper part is black, friable muck, and the lower part is light brownish gray, loose sand. The upper part of the substratum is black, friable muck. The lower part to a depth of 60 inches is brownish gray sand.

Typically, the surface layer of the Carlisle soils is black muck about 10 inches thick. The subsoil is black, friable muck about 50 inches thick.

The common minor soils in this association are the poorly drained, sandy Granby and Kingsville and very poorly drained Adrian soils in landscape positions similar to those of the Houghton and Carlisle soils and the somewhat poorly drained Saugatuck soils in the slightly higher landscape positions. Adrian soils are mucky in the upper part and sandy in the lower part.

Most areas of this association are wooded. An equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns.

11. Medisaprists, Euic-Typic Haplaquolls, Sandy Over Loamy-Mollic Psammaquents Association

Nearly level, very poorly drained and poorly drained, mucky soils underlain by sandy or loamy material; on outwash plains, lake plains, ground moraines, and flood plains

Medisaprists, euic, are in depressions on outwash plains, ground moraines, and flood plains. Typic Haplaquolls, sandy over loamy, are in depressions on ground moraines, lake plains, and flood plains. Mollic Psammaquents are in depressions on flood plains, lake plains, and outwash plains. Slope ranges from 0 to 2 percent.

This association makes up about 2 percent of the county. It is about 38 percent Medisaprists and similar soils, 30 percent Typic Haplaquolls and similar soils, 15 percent Mollic Psammaquents and similar soils, and 17 percent soils of minor extent.

The Medisaprists are very poorly drained. Typically, the upper part of these soils is well decomposed muck 16 to more than 51 inches thick. Below this is sandy or loamy material.

The Typic Haplaquolls are very poorly drained. Typically, the surface layer is black muck about 2 inches thick. The subsurface layer is black loamy fine sand about 8 inches thick. The subsoil is gray, mottled, very friable loamy fine sand about 4 inches thick. The upper part of the substratum is grayish brown, mottled loamy fine sand. The next part is brown sandy clay loam. The lower part to a depth of 60 inches is grayish brown silty clay loam.

The Mollic Psammaquents are poorly drained. Typically, the surface layer is black muck about 3 inches thick. The subsurface layer is black sandy loam about 5 inches thick. The subsoil is light brownish gray, mottled, friable sand about 12 inches thick. The substratum to a depth of 60 inches is pale brown and light brownish gray sand.

The common minor soils in this association are the moderately well drained Aquic Udipsamments in the slightly higher landscape positions and the excessively drained Entic Haplorthods, sandy, and well drained Alfic Haplorthods, sandy, on knolls.

This association is wooded. An equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns.

Broad Land Use Considerations

The general soil map can help those who plan building site development, farming, recreational development, and other uses on a countywide scale. The map is suitable for broad land use planning but is not suitable for selecting a site for a specific use.

The parts of the county that are suited to building site development consist of the less sloping soils in the Plainfield-Coloma-Grattan, Benona-Spinks-Grattan, and Spinks-Remus-Fern associations and the well drained soils in the Perrinton-Gowdy-Ithaca and Claybanks-Nappanee-Hoytville associations. Some of these soils are considered prime farmland. The seasonal high water table in most areas of the Grattan-Covert-Granby, Houghton-Kerston-Carlisle, and Medisaprists, euic-Typic Haplaquolls, sandy over loamy-Mollic Psammaquents associations and the slope of the rolling to very steep soils in the Epworth-Dune land-Nordhouse, Plainfield-Coloma-Grattan, Benona-Spinks-Grattan, and Spinks-Remus-Fern associations severely limit building site development.

The Spinks-Remus-Fern, Claybanks-Nappanee-Hoytville, and Perrinton-Gowdy-Ithaca associations are farmed. In areas near Lake Michigan where air drainage is good, the excessively drained and well drained, rolling soils in the Benona-Spinks-Grattan and Spinks-Remus-Fern associations are suited to tree fruits, such as cherries, peaches, apples, and plums.

Most of the soils in the county are well suited or fairly well suited to woodland. The largest areas of woodland are in the Benona-Spinks-Grattan and Plainfield-Coloma-Grattan associations.

The major soils in the Epworth-Dune land-Nordhouse and Plainfield-Coloma-Grattan associations are suited to recreational uses. The Dune land along Lake Michigan and the sandy Epworth and Plainfield soils on broad plains can be used for such recreational activities as camping, hiking, and cross-country skiing. The Dune land along Lake Michigan, particularly in the Silver Lake recreational area, provides opportunities for driving off-road vehicles. Careful planning is necessary, however, to prevent severe erosion in areas of the Nordhouse soils, and environmental concerns should be addressed.

The Houghton-Kerston-Carlisle and Medisaprists, euic-Typic Haplaquolls, sandy over loamy-Mollic Psammaquents associations are suited to wildlife habitat and provide good opportunities for nature study.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under the heading "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Grattan sand, dark subsoil, 0 to 6 percent slopes, is a phase of the Grattan series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Gowdy-Perrinton complex, 1 to 6 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Histosols and Aquents, ponded, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Beaches is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Some of the boundaries on the detailed soil maps of Oceana County do not match those on the maps of adjacent counties, and some of the soil names and soil descriptions in the adjacent counties are not the same as those in Oceana County. Differences are the result of refinements in soil series concepts or variations in the intensity of mapping or in the extent of the soils in the counties.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

10B—Perrinton loam, 2 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines

Shape of areas: Irregular
Size of areas: 3 to 625 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loam

Subsoil:
9 to 18 inches—grayish brown fine sandy loam and dark brown, mottled, firm silty clay loam
18 to 35 inches—dark brown silty clay loam and strong brown, firm silty clay

Substratum:
35 to 60 inches—dark brown and yellowish brown silty clay

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: None

Composition

Perrinton soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Arkona and Ithaca soils in drainageways and on foot slopes
- The well drained Gowdy soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Perrinton soil
- The poorly drained Bono soils in depressions

Similar inclusions:
- Areas where the substratum is sandy at a depth of more than 40 inches
- Areas where the subsoil has less clay
- Areas where the substratum is stratified
- Areas where the surface layer is moderately eroded
- Areas where the soil is moderately well drained

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, seasonal wetness, slow permeability, compaction, tilth in the surface layer

Management measures:
- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Subsurface drains can improve drainage in low areas.
- Because of slow permeability, subsurface drains should be closely spaced.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Shrink-swell potential

Management measures:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Slow permeability

Management measures:
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 4A
Michigan soil management group: 1.5a

10C—Perrinton loam, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 200 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loam
Subsoil:
9 to 18 inches—grayish brown fine sandy loam and dark brown, firm silty clay loam
18 to 35 inches—dark brown silty clay loam and strong brown, firm silty clay
Substratum:
35 to 60 inches—dark brown and yellowish brown silty clay

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: None

Composition

Perrinton soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona and Ithaca soils in drainageways and on foot slopes
- The well drained Gowdy soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Perrinton soil

Similar inclusions:

- Areas where the substratum is sandy at a depth of more than 40 inches
- Areas where the subsoil has less clay
- Areas where the substratum is stratified
- Areas where the surface layer is moderately eroded

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, compaction, tilth in the surface layer

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Shrink-swell potential, slope

Management measures:

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Slow permeability

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4A
Michigan soil management group: 1.5a

10D—Perrinton loam, 12 to 18 percent slopes

Setting

Landform: Hilly areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 35 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loam
Subsoil:
9 to 18 inches—grayish brown fine sandy loam and

dark brown, firm silty clay loam
18 to 35 inches—dark brown silty clay loam and strong brown, firm silty clay

Substratum:
35 to 60 inches—dark brown and yellowish brown silty clay

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: None

Composition

Perrinton soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The well drained Gowdy soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Perrinton soil

Similar inclusions:
- Areas where the substratum is sandy at a depth of more than 40 inches
- Areas where the subsoil has less clay
- Areas where the substratum is stratified
- Areas where the surface layer is moderately eroded or severely eroded

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, compaction, tilth in the surface layer

Management measures:
- Water erosion can be controlled by diversions, crop residue management, contour stripcropping, field stripcropping, cover crops, grassed waterways, conservation tillage, crop rotations that include grasses and legumes, grade stabilization structures, or a combination of these.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction, overgrazing

Management measures:
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Shrink-swell potential, slope

Management measures:
- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Slow permeability, slope

Management measures:
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 4A
Michigan soil management group: 1.5a

10E—Perrinton loam, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines
Shape of areas: Irregular
Size of areas: 3 to 35 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loam

Subsoil:
9 to 18 inches—grayish brown fine sandy loam and dark brown, firm silty clay loam
18 to 35 inches—dark brown silty clay loam and strong brown, firm silty clay

Substratum:
35 to 60 inches—dark brown and yellowish brown silty clay

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: None

Composition

Perrinton soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The well drained Gowdy soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Perrinton soil

Similar inclusions:
- Areas where the substratum is sandy at a depth of more than 40 inches
- Areas where the subsoil has less clay
- Areas where the substratum is stratified
- Areas where the surface layer is severely eroded
- Areas where the slope is more than 35 percent

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation

Management measures:
- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.

Buildings

Major management concerns: Slope, shrink-swell potential
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope, slow permeability
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 4R
Michigan soil management group: 1.5a

11A—Ithaca loam, 0 to 3 percent slopes

Setting

Landform: Drainageways on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 225 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark gray loam

Subsoil:
9 to 13 inches—pale brown fine sandy loam and dark brown, firm clay loam
13 to 24 inches—dark brown, mottled, firm clay loam
24 to 60 inches—dark yellowish brown and brown, mottled clay loam

Soil Properties and Qualities

Permeability: Slow
Available water capacity: High
Drainage class: Somewhat poorly drained
Seasonal high water table: 1 to 2 feet below the surface from October through May
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: None

Composition

Ithaca soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- Arkona soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Ithaca soil
- The very poorly drained Bono soils in depressions
- The well drained Marlette and Perrinton soils in the slightly higher landscape positions

Similar inclusions:
- Areas where the subsoil has less clay
- Areas where the substratum is sandy

- Areas where the substratum is stratified
- Areas where the subsoil has more clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, seasonal wetness, slow permeability, compaction, tilth in the surface layer

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Surface and subsurface drainage systems are needed to reduce the wetness.
- Because of slow permeability, subsurface drains should be closely spaced.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: Equipment limitation

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:

- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Seasonal wetness

Management measures:

- A surface or subsurface drainage system helps to lower the water table.
- Buildings can be constructed on well compacted fill material that raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Seasonal wetness, slow permeability

Management measures:

- A subsurface drainage system helps to lower the water table.
- Mounding or adding suitable fill material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 4W
Michigan soil management group: 1.5b

12—Bono silt loam

Setting

Landform: Depressions and drainageways on lake plains and ground moraines
Slope: 0 to 2 percent
Shape of areas: Irregular or elongated
Size of areas: 3 to 35 acres

Typical Profile

Surface layer:
0 to 11 inches—very dark gray silt loam

Subsoil:
11 to 32 inches—dark gray and light gray, mottled, firm silty clay loam

Substratum:
32 to 60 inches—olive gray and light yellowish brown, mottled silty clay loam

Soil Properties and Qualities

Permeability: Slow
Available water capacity: Moderate
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from December through May
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: None

Composition

Bono soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Del Rey and Ithaca soils in the slightly higher landscape positions

Similar inclusions:

- Areas where the subsoil has less clay
- Areas where the substratum is sandy at a depth of more than 40 inches

Use and Management

Land use: Dominant use—cropland; other uses—woodland, building site development

Cropland

Major management concerns: Ponding, slow permeability, compaction, tilth in the surface layer

Management measures:

- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Because of slow permeability, subsurface drains should be closely spaced.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, seasonal wetness

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soil is frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Buildings

Major management concerns: Ponding, shrink-swell potential

- Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding, slow permeability

- Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 4W
Michigan soil management group: 1.5c

13B—Marlette fine sandy loam, 2 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 320 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray fine sandy loam

Subsoil:
8 to 12 inches—light brownish gray fine sandy loam and dark brown, mottled, firm clay loam
12 to 25 inches—dark brown, firm clay loam and silty clay loam

Substratum:
25 to 60 inches—brown clay loam

Soil Properties and Qualities

Permeability: Moderately slow
Available water capacity: High
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Moderate

Composition

Marlette soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Capac and Ithaca soils in drainageways and on foot slopes
- The well drained Fern soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Marlette soil

Similar inclusions:

- Areas where the substratum is sandy at a depth of more than 40 inches
- Areas where the subsoil has less clay
- Areas where the substratum is stratified
- Areas where the surface layer is moderately eroded
- Areas where the soil is moderately well drained

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, compaction, tilth in the surface layer

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: None

Septic tank absorption fields

Major management concerns: Moderately slow permeability

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 3A
Michigan soil management group: 1.5a

13C—Marlette fine sandy loam, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 180 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray fine sandy loam

Subsoil:
8 to 12 inches—light brownish gray fine sandy loam and dark brown, mottled, firm clay loam
12 to 25 inches—dark brown, firm clay loam and silty clay loam

Substratum:
25 to 60 inches—brown clay loam

Soil Properties and Qualities

Permeability: Moderately slow
Available water capacity: High
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Moderate

Composition

Marlette soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Capac and Ithaca soils in drainageways, on foot slopes, and in swales
- The well drained Fern soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Marlette soil

Similar inclusions:

- Areas where the substratum is sandy at a depth of more than 40 inches
- Areas where the subsoil has less clay
- Areas where the substratum is stratified
- Areas where the surface layer is moderately eroded

Use and Management

Land use: Dominant uses—cropland, woodland; other

uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, compaction, tilth in the surface layer

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Conservation tillage, vegetative barriers, and cover crops help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and rotation grazing or a planned grazing system help to keep the pasture in good condition.

Buildings

Major management concerns: Slope

Management measures:

- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Moderately slow permeability

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3A
Michigan soil management group: 1.5a

13D—Marlette fine sandy loam, 12 to 18 percent slopes

Setting

Landform: Hilly areas on end moraines
Shape of areas: Irregular
Size of areas: 3 to 35 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray fine sandy loam
Subsoil:
8 to 12 inches—light brownish gray fine sandy loam and dark brown, mottled, firm clay loam
12 to 25 inches—dark brown, firm clay loam and silty clay loam
Substratum:
25 to 60 inches—brown clay loam

Soil Properties and Qualities

Permeability: Moderately slow
Available water capacity: High
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Moderate

Composition

Marlette soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:

- The well drained Fern soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Marlette soil

Similar inclusions:

- Areas where the substratum is sandy at a depth of more than 40 inches
- Areas where the subsoil has less clay
- Areas where the substratum is stratified
- Areas where the surface layer is moderately eroded or severely eroded

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, compaction, tilth in the surface layer

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Conservation tillage, vegetative barriers, and cover crops help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Grassed waterways, diversions, and grade stabilization structures help to prevent gully erosion.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and rotation grazing or a planned grazing system help to keep the pasture in good condition.

Buildings

Major management concerns: Slope

Management measures:

- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Moderately slow permeability, slope

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3A
Michigan soil management group: 1.5a

14B—Capac fine sandy loam, 0 to 4 percent slopes

Setting

Landform: Depressions and drainageways on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 50 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown fine sandy loam

Subsurface layer:
9 to 14 inches—brown, mottled fine sandy loam

Subsoil:
14 to 17 inches—brown, mottled, friable clay loam and fine sandy loam
17 to 36 inches—brown, mottled, firm silty clay loam

Substratum:
36 to 80 inches—brown, mottled loam

Soil Properties and Qualities

Permeability: Moderately slow
Available water capacity: High
Drainage class: Somewhat poorly drained
Seasonal high water table: 1 to 2 feet below the surface from November through May
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Moderate

Composition

Capac soil and similar soils: 5 to 15 percent
Contrasting inclusions: 85 to 95 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Capac soil
- The poorly drained Bono soils in depressions
- The well drained Marlette and Scalley soils in the slightly higher landscape positions

Similar inclusions:

- Areas where the subsoil has less clay
- Areas where the substratum is sandy

- Areas where the substratum is stratified
- Areas where the subsoil has more clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, seasonal wetness, moderately slow permeability, soil blowing, compaction, tilth in the surface layer

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Surface and subsurface drainage systems are needed to reduce the wetness.
- Because of moderately slow permeability, subsurface drains should be closely spaced.
- Vegetative barriers, cover crops, and windbreaks help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: Equipment limitation

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:

- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and a planned grazing system help to keep the pasture in good condition.

Buildings

Major management concerns: Seasonal wetness

Management measures:

- Buildings can be constructed on well compacted fill material that raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Seasonal wetness, moderately slow permeability

Management measures:

- Mounding or adding suitable fill material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 4W
Michigan soil management group: 1.5b

16B—Remus fine sandy loam, 1 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 210 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown fine sandy loam

Subsoil:
9 to 21 inches—pale brown loamy sand and dark brown, friable loam
21 to 50 inches—dark reddish brown and brown, firm loam and sandy clay loam

Substratum:
50 to 60 inches—brown sandy clay loam

Soil Properties and Qualities

Permeability: Moderately slow
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Moderate

Composition

Remus soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Fern and Spinks soils, which have a

sandy surface layer and subsoil and are in landscape positions similar to those of the Remus soil
- The somewhat poorly drained Thetford soils in drainageways and on foot slopes

Similar inclusions:
- Areas where the subsoil has less clay
- Areas where the surface layer is moderately eroded
- Areas where the subsoil has more clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, compaction, tilth in the surface layer, a low content of organic matter

Management measures:
- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Vegetative barriers, cover crops, and windbreaks help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction, overgrazing

Management measures:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: None

Septic tank absorption fields

Major management concerns: Moderately slow permeability

Management measures:
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 3A
Michigan soil management group: 2.5a

16C—Remus fine sandy loam, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 210 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown fine sandy loam

Subsoil:
9 to 21 inches—pale brown loamy sand and dark brown, friable loam
21 to 50 inches—dark reddish brown and brown, firm loam and sandy clay loam

Substratum:
50 to 60 inches—brown sandy clay loam

Soil Properties and Qualities

Permeability: Moderately slow
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Moderate

Composition

Remus soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The well drained Fern and Spinks soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Remus soil
- The somewhat poorly drained Thetford soils in drainageways and on foot slopes

Similar inclusions:
- Areas where the subsoil has less clay
- Areas where the surface layer is moderately eroded
- Areas where the subsoil has more clay

Use and Management

Land use: Dominant uses—cropland, woodland; other

uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, compaction, tilth in the surface layer, a low content of organic matter

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Vegetative barriers, cover crops, and windbreaks help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Slope

Management measures:

- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Moderately slow permeability

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3A
Michigan soil management group: 2.5a

16D—Remus fine sandy loam, 12 to 18 percent slopes

Setting

Landform: Hilly areas on end moraines
Shape of areas: Irregular
Size of areas: 3 to 60 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown fine sandy loam

Subsoil:
9 to 21 inches—pale brown loamy sand and dark brown, friable loam
21 to 50 inches—dark reddish brown and brown, firm loam and sandy clay loam

Substratum:
50 to 60 inches—brown sandy clay loam

Soil Properties and Qualities

Permeability: Moderately slow
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Moderate

Composition

Remus soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:

- The well drained Fern and Spinks soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Remus soil

Similar inclusions:

- Areas where the subsoil has less clay
- Areas where the surface layer is moderately eroded or severely eroded
- Areas where the subsoil has more clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, tilth in the surface layer, compaction, a low content of organic matter

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Windbreaks and vegetative barriers help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Slope

Management measures:

- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Moderately slow permeability, slope

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3A
Michigan soil management group: 2.5a

17B—Marlette-Fern complex, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Marlette

Surface layer:
0 to 8 inches—very dark gray fine sandy loam

Subsoil:
8 to 12 inches—light brownish gray fine sandy loam and dark brown, mottled, firm clay loam
12 to 25 inches—dark brown, firm clay loam and silty clay loam

Substratum:
25 to 60 inches—brown clay loam

Fern

Surface layer:
0 to 10 inches—dark brown, friable loamy fine sand

Subsoil:
10 to 21 inches—brown loamy fine sand
21 to 30 inches—pale brown loamy fine sand and dark brown, friable loam
30 to 51 inches—reddish brown, friable clay loam and pale brown loamy fine sand
51 to 60 inches—dark brown, friable loam

Soil Properties and Qualities

Permeability: Marlette—moderately slow; Fern—rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Marlette—high; Fern—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Marlette—medium; Fern—very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Marlette soil and similar soils: 40 to 65 percent
Fern soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona and Ithaca soils in drainageways and on foot slopes
- The very poorly drained Lamson soils in depressions
- The well drained Spinks soils, which are sandy in the lower part of the subsoil and are in landscape positions similar to those of the Marlette and Fern soils

Similar inclusions:

- Areas of Fern soils that have more clay in the substratum
- Areas of Marlette soils that are sandy at a depth of more than 40 inches
- Areas of Marlette soils in which the subsoil has more clay
- Areas of moderately well drained Marlette soils

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion on both soils; compaction and tilth in the surface layer in areas of the Marlette soil; soil blowing, seasonal droughtiness, and a low content of organic matter in areas of the Fern soil

Management measures:

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation and seedling mortality on the Fern soil

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Compaction in areas of the Marlette soil, seasonal droughtiness in the Fern soil, overgrazing on both soils

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks in areas of the Fern soil

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: The permeability throughout the Marlette soil and in the lower part of the subsoil and in the substratum of the Fern soil

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: Marlette—3A; Fern—4S
Michigan soil management group: Marlette—1.5a; Fern—4/2a

17C—Marlette-Fern complex, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 15 to 120 acres

Typical Profile

Marlette

Surface layer:
0 to 8 inches—very dark gray fine sandy loam

Subsoil:
8 to 12 inches—light brownish gray fine sandy loam and dark brown, firm clay loam
12 to 25 inches—dark brown, firm clay loam and silty clay loam

Substratum:
25 to 60 inches—brown clay loam

Fern

Surface layer:
0 to 10 inches—dark brown loamy fine sand

Subsoil:
10 to 21 inches—brown, friable loamy fine sand
21 to 30 inches—pale brown loamy fine sand and dark brown, friable loam
30 to 51 inches—reddish brown, friable clay loam and pale brown loamy fine sand

Substratum:
51 to 60 inches—dark brown, friable loam

Soil Properties and Qualities

Permeability: Marlette—moderately slow; Fern—rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Marlette—high; Fern—low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Marlette—moderate; Fern—slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Marlette soil and similar soils: 40 to 65 percent
Fern soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona and Ithaca soils in drainageways and on foot slopes
- The well drained Spinks soils, which are sandy in the lower part of the subsoil and are in landscape positions similar to those of the Marlette and Fern soils

Similar inclusions:

- Areas of Fern soils in which the substratum has less clay
- Areas of Marlette soils that are sandy at a depth of more than 40 inches
- Areas of Marlette soils in which the subsoil has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion on both soils; tilth in the Marlette soil; soil blowing, seasonal droughtiness, and a low content of organic matter in areas of the Fern soil

Management measures:

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Crop residue management, no-till planting, a cropping sequence that includes grasses and legumes, and minimum tillage help to maintain tilth.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation and seedling mortality on the Fern soil

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Compaction in areas of the Marlette soil, seasonal droughtiness in the Fern soil, overgrazing on both soils

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness,

and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks in areas of the Fern soil, the slope of both soils

Management measures:

- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Permeability throughout the Marlette soil and in the lower part of the subsoil and in the substratum of the Fern soil

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Marlette—3A; Fern—4S
Michigan soil management group: Fern—4/1a; Marlette—1.5a

17D—Marlette-Fern complex, 12 to 18 percent slopes

Setting

Landform: Hilly areas on end moraines
Shape of areas: Irregular
Size of areas: 15 to 120 acres

Typical Profile

Marlette

Surface layer:
0 to 8 inches—very dark gray fine sandy loam
Subsoil:
8 to 17 inches—light brownish gray fine sandy loam and dark brown, firm clay loam
12 to 25 inches—dark brown, firm clay loam and silty clay loam
Substratum:
25 to 60 inches—brown clay loam

Fern

Surface layer:
0 to 10 inches—dark brown loamy fine sand
Subsoil:
10 to 21 inches—brown, friable loamy fine sand
21 to 30 inches—pale brown loamy fine sand and dark brown, friable loam
30 to 51 inches—reddish brown, friable clay loam and pale brown loamy fine sand
Substratum:
51 to 60 inches—dark brown, friable loam

Soil Properties and Qualities

Permeability: Marlette—moderately slow; Fern—rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Marlette—high; Fern—low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Marlette—rapid; Fern—slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Marlette soil and similar soils: 40 to 65 percent
Fern soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The well drained Spinks soils, which are sandy in the lower part of the subsoil and are in landscape positions similar to those of the Marlette and Fern soils

Similar inclusions:

- Areas of Fern soils in which the substratum has less clay
- Areas of Marlette soils that are sandy at a depth of more than 40 inches
- Areas of Marlette soils in which the subsoil has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion on both soils; tilth in the Marlette soil; soil blowing, seasonal droughtiness, and a low content of organic matter in areas of the Fern soil

Management measures:

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Crop residue management, no-till planting, a cropping sequence that includes grasses and legumes, and minimum tillage help to maintain tilth.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.

- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation and seedling mortality on the Fern soil

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Compaction in areas of the Marlette soil, seasonal droughtiness in the Fern soil, overgrazing on both soils

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks in areas of the Fern soil, the slope of both soils

Management measures:

- The sides of shallow excavations should be reinforced.
- Because of the slope, these soils are poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Permeability throughout the Marlette soil and in the lower part of the subsoil and in the substratum of the Fern soil, the slope of both soils

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Marlette 3A; Fern—4S
Michigan soil management group: Fern—4/1a; Marlette—1.5a

18B—Spinks-Gowdy loamy fine sands, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 15 to 85 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Gowdy

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsoil:
9 to 28 inches—brown and yellowish brown, loose fine sand
28 to 32 inches—dark brown, firm silty clay loam and pale brown fine sandy loam
32 to 42 inches—strong brown, firm silty clay loam

Substratum:
42 to 60 inches—strong brown silty clay loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Gowdy—rapid in the upper part of the profile and slow in the lower part
Available water capacity: Spinks—low; Gowdy—moderate

Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 60 percent
Gowdy soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The excessively drained Grattan soils, which are sandy throughout and are in landscape positions similar to those of the Spinks and Gowdy soils
- The somewhat poorly drained Arkona soils in drainageways and on foot slopes

Similar inclusions:

- Areas where the Spinks soil has more than 15 percent gravel
- Areas where the subsoil of the Spinks soil has less than 6 inches of lamellae
- Areas where the substratum of the Gowdy soil has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Soil blowing on both soils, water erosion on the Gowdy soil, seasonal droughtiness and a low content of organic matter in both soils

Management measures:

- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Crop rotations that include grasses and legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: A high shrink-swell potential in the lower part of the subsoil and in the substratum of the Gowdy soil, the instability of cutbanks in areas of both soils

Management measures:

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: In the Gowdy soil, slow permeability in the lower part of the subsoil and in the substratum and rapid permeability in the upper part of the subsoil, which causes poor filtering and a hazard of ground-water pollution

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: Spinks—4A; Gowdy—3A
Michigan soil management group: Spinks—4a; Gowdy—4/1a

18C—Spinks-Gowdy loamy fine sands, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 15 to 85 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown fine sand

Subsoil:
9 to 18 inches—strong brown, very friable loamy fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Gowdy

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsoil:
9 to 28 inches—brown and yellowish brown, loose fine sand
28 to 32 inches—dark brown, firm silty clay loam and pale brown fine sandy loam
32 to 42 inches—strong brown, firm silty clay loam

Substratum:
42 to 60 inches—strong brown silty clay loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Gowdy—rapid in the upper part of the profile and slow in the lower part
Available water capacity: Spinks—low; Gowdy—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 60 percent
Gowdy soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The excessively drained Grattan soils, which are sandy throughout and are in landscape positions similar to those of the Spinks and Gowdy soils
- The somewhat poorly drained Arkona soils in drainageways and on foot slopes

Similar inclusions:
- Areas where the Spinks soil has more than 15 percent gravel
- Areas where the subsoil of the Spinks soil has less than 6 inches of lamellae
- Areas where the substratum of the Gowdy soil has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:
- Crop rotations that include grasses and legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: A high shrink-swell potential in the lower part of the subsoil and in the substratum of the Gowdy soil, the instability of cutbanks and the slope in areas of both soils

Management measures:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- The sides of shallow excavations should be reinforced.

- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: In the Gowdy soil, slow permeability in the lower part of the subsoil and in the substratum and rapid permeability in the upper part of the subsoil, which causes poor filtering and a hazard of ground-water pollution

Management measures:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Spinks—4A; Gowdy—3A
Michigan soil management group: Spinks—4a; Gowdy—4/1a

18D—Spinks-Gowdy loamy fine sands, 12 to 18 percent slopes

Setting

Landform: Hilly areas on end moraines
Shape of areas: Irregular
Size of areas: 15 to 85 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown fine sand

Subsoil:
9 to 18 inches—strong brown, very friable loamy fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Gowdy

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsoil:
9 to 28 inches—brown and yellowish brown, loose fine sand
28 to 32 inches—dark brown, firm silty clay loam and pale brown fine sandy loam
32 to 42 inches—strong brown, firm silty clay loam

Substratum:
42 to 60 inches—strong brown silty clay loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Gowdy—rapid in the upper part of the profile and slow in the lower part
Available water capacity: Spinks—low; Gowdy—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 60 percent
Gowdy soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The excessively drained Grattan soils, which are sandy throughout and are in landscape positions similar to those of the Spinks and Gowdy soils

Similar inclusions:
- Areas where the Spinks soil has more than 15 percent gravel
- Areas where the subsoil of the Spinks soil has less than 6 inches of lamellae
- Areas where the substratum of the Gowdy soil has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:
- Crop rotations that include grasses and legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer

are applied should not exceed the nutrient requirements of the crops.

- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: A high shrink-swell potential in the lower part of the subsoil and in the substratum of the Gowdy soil, the instability of cutbanks and the slope in areas of both soils

Management measures:

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- The sides of shallow excavations should be reinforced.
- Because of the slope, these soils are poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: In the Gowdy soil, slow permeability in the lower part of the subsoil and in the substratum and rapid permeability in the upper part of the subsoil, which causes poor filtering and a hazard of ground-water pollution; the slope of both soils

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Spinks—4A; Gowdy—3A
Michigan soil management group: Spinks—4a; Gowdy—4/1a

20B—Arkport-Chelsea complex, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on glacial deltas
Shape of areas: Irregular or elongated
Size of areas: 10 to 130 acres

Typical Profile

Arkport

Surface layer:
0 to 8 inches—dark brown loamy very fine sand
Subsoil:
8 to 22 inches—yellowish brown, friable loamy very fine sand
22 to 60 inches—pale brown very fine sand that has lamellae of strong brown, friable very fine sandy loam

Chelsea

Surface layer:
0 to 9 inches—very dark grayish brown fine sand
Subsoil:
9 to 39 inches—strong brown, yellowish brown, and brownish yellow, loose fine sand
39 to 60 inches—light yellowish brown, loose fine sand that has lamellae of dark brown and strong brown, loose loamy fine sand

Soil Properties and Qualities

Permeability: Arkport—moderately rapid; Chelsea—rapid
Available water capacity: Low
Drainage class: Arkport—well drained; Chelsea—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Arkport—medium; Chelsea—very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Arkport soil and similar soils: 40 to 55 percent
Chelsea soil and similar soils: 35 to 45 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The poorly drained Kingsville and Lamson soils in depressions
- The somewhat poorly drained Dixboro, Freesoil, and Thetford soils in drainageways and on foot slopes

Similar inclusions:

- Areas where the subsoil is medium sand

- Areas where the subsoil in the Chelsea soil has more than 6 inches of lamellae
- Areas where the subsoil has loamy material at a depth of more than 60 inches

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, and a low content of organic matter in areas of both soils; compaction and tilth in the surface layer of the Arkport soil

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Field windbreaks, vegetative barriers, crop residue management, and cover crops, such as rye, help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: Seedling mortality on the Chelsea soil

Management measures:

- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Compaction in areas of the Arkport soil, seasonal droughtiness and overgrazing on both soils

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability in the Chelsea soil, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: Arkport—3A; Chelsea—5S
Michigan soil management group: Arkport—3a-s; Chelsea—5a

20C—Arkport-Chelsea complex, 6 to 12 percent slopes

Setting

Landform: Rolling areas on glacial deltas
Shape of areas: Irregular or elongated
Size of areas: 10 to 100 acres

Typical Profile

Arkport

Surface layer:
0 to 8 inches—dark brown loamy very fine sand

Subsoil:
8 to 22 inches—yellowish brown, friable loamy very fine sand
22 to 60 inches—pale brown very fine sand that has lamellae of strong brown, friable very fine sandy loam

Chelsea

Surface layer:
0 to 9 inches—very dark grayish brown fine sand

Subsoil:
9 to 39 inches—strong brown, yellowish brown, and brownish yellow, loose fine sand
39 to 60 inches—light yellowish brown, loose fine sand that has lamellae of dark brown and strong brown, loose loamy fine sand

Soil Properties and Qualities

Permeability: Arkport—moderately rapid; Chelsea—rapid
Available water capacity: Low
Drainage class: Arkport—well drained; Chelsea—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Arkport—medium; Chelsea—slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Arkport soil and similar soils: 50 to 70 percent
Chelsea soil and similar soils: 30 to 45 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Freesoil soils in drainageways and on foot slopes

Similar inclusions:

- Areas where the subsoil is medium sand
- Areas where the subsoil in the Chelsea soil has more than 6 inches of lamellae
- Areas where the subsoil has loamy material at a depth of more than 60 inches

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, and a low content of organic matter in areas of both soils; compaction and tilth in the surface layer of the Arkport soil

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Field windbreaks, vegetative barriers, crop residue management, and cover crops, such as rye, help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: Seedling mortality on the Chelsea soil

Management measures:

- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Compaction in areas of the Arkport soil, seasonal droughtiness and overgrazing on both soils

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability in the Chelsea soil, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Arkport—3A; Chelsea—5S
Michigan soil management group: Arkport—3a-s; Chelsea—5a

20D—Arkport-Chelsea complex, 12 to 18 percent slopes

Setting

Landform: Hilly areas on glacial deltas
Shape of areas: Irregular or elongated
Size of areas: 10 to 80 acres

Typical Profile

Arkport

Surface layer:

0 to 8 inches—dark brown loamy very fine sand

Subsoil:

8 to 22 inches—yellowish brown, friable loamy very fine sand
22 to 60 inches—pale brown very fine sand that has lamellae of strong brown, friable very fine sandy loam

Chelsea

Surface layer:

0 to 9 inches—very dark grayish brown fine sand

Subsoil:

9 to 39 inches—strong brown, yellowish brown, and brownish yellow, loose fine sand
39 to 60 inches—light yellowish brown, loose fine sand that has lamellae of dark brown and strong brown, loose loamy fine sand

Soil Properties and Qualities

Permeability: Arkport—moderately rapid; Chelsea—rapid
Available water capacity: Low
Drainage class: Arkport—well drained; Chelsea—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Arkport—rapid; Chelsea—slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Arkport soil and similar soils: 55 to 70 percent
Chelsea soil and similar soils: 30 to 45 percent

Inclusions

Similar inclusions:

- Areas where the subsoil is medium sand
- Areas where the subsoil in the Chelsea soil has more than 6 inches of lamellae
- Areas where the subsoil has loamy material at a depth of more than 60 inches

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, and a low content of organic matter in areas of both soils; compaction and tilth in the surface layer of the Arkport soil

Management measures:

- Water erosion can be controlled by diversions, crop residue management, contour stripcropping, field stripcropping, cover crops, grassed waterways, conservation tillage, crop rotations that include grasses and legumes, grade stabilization structures, or a combination of these.
- Field windbreaks, vegetative barriers, crop residue management, and cover crops, such as rye, help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: Seedling mortality on the Chelsea soil

Management measures:

- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Compaction in areas of the Arkport soil, seasonal droughtiness and overgrazing on both soils

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing

during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Slope, the instability of cutbanks

Management measures:

- Because of the slope, these soils are poorly suited to building site development without extensive land shaping.
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: The slope of both soils; rapid permeability in the Chelsea soil, which causes poor filtering and a hazard of ground-water pollution

Management measures:

- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Arkport—3A; Chelsea—5S
Michigan soil management group: Arkport—3a-s; Chelsea—5a

21A—Freesoil loamy very fine sand, 0 to 3 percent slopes

Setting

Landform: Drainageways on glacial deltas and lake plains
Shape of areas: Irregular
Size of areas: 3 to 100 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark gray loamy very fine sand

Subsoil:
9 to 24 inches—yellowish brown, mottled, friable loamy very fine sand

Substratum:
24 to 60 inches—brown, stratified loamy very fine sand and very fine sand having thin lamellae of strong brown, mottled silt

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Seasonal high water table: 0.5 foot to 1.5 feet below the surface from November through May
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Freesoil soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Arkport and excessively drained Chelsea soils in the higher landscape positions
- The very poorly drained Lamson soils in depressions
- Pipestone soils, which are sandy throughout and are in landscape positions similar to those of the Freesoil soil

Similar inclusions:

- Areas where the subsoil has an accumulation of clay

Use and Management

Land use: Dominant uses—cropland, pasture; other uses—woodland, building site development

Cropland

Major management concerns: Seasonal wetness, water erosion, soil blowing, compaction, tilth in the surface layer

Management measures:

- Surface and subsurface drainage systems are needed to reduce the wetness.
- Subsurface drainage systems should be designed so that the rate of flowing water helps to keep fine sand and silt from plugging the tile lines. Also, suitable filtering material may be needed to keep the silt and fine sand from flowing into the tile lines.
- Crop rotations that include grasses and legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
- Field windbreaks, vegetative barriers, crop residue management, and cover crops, such as rye, help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved

and particulate nitrogen and phosphorus.

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Trees that can withstand seasonal wetness should be selected for planting.
- Special site preparation, such as bedding before planting, can reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Buildings

Major management concerns: Seasonal wetness, the instability of cutbanks

Management measures:

- A surface or subsurface drainage system helps to lower the water table.
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness

Management measures:

- Mounding or adding suitable fill material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 3W
Michigan soil management group: 3b-s

22B—Gowdy loamy fine sand, 1 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 125 acres

Typical Profile

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsoil:
9 to 28 inches—brown and yellowish brown, loose fine sand
28 to 32 inches—dark brown and pale brown, firm silty clay and fine sandy loam
32 to 42 inches—strong brown, firm silty clay loam

Substratum:
42 to 60 inches—strong brown silty clay loam

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and slow in the lower part
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Gowdy soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Scalley and Perrinton soils, which have a loamy surface layer and a clayey subsoil and are in landscape positions similar to those of the Gowdy soil
- The well drained Spinks soils, which have loamy lamellae in the subsoil and are in landscape positions similar to those of the Gowdy soil
- The somewhat poorly drained Arkona soils in drainageways and on foot slopes

Similar inclusions:

- Areas where the substratum has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Crop rotations that include grasses and legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.

- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: A high shrink-swell potential in the lower part of the subsoil and in the substratum, the instability of cutbanks

Management measures:

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability in the upper part of the subsoil, which causes poor filtering and a hazard of ground-water pollution; slow permeability in the lower part of the subsoil and in the substratum

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 3A
Michigan soil management group: 4/1a

22C—Gowdy loamy fine sand, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 120 acres

Typical Profile

Surface layer:
0 to 9 inches—dark brown loamy fine sand
Subsoil:
9 to 28 inches—brown and yellowish brown, loose fine sand
28 to 32 inches—dark brown and pale brown, firm silty clay and fine sandy loam
32 to 42 inches—strong brown, firm silty clay loam
Substratum:
42 to 60 inches—strong brown silty clay loam

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and slow in the lower part
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Gowdy soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Perrinton and Scalley soils, which have a loamy surface layer and a clayey subsoil and are in landscape positions similar to those of the Gowdy soil
- The well drained Spinks soils, which have loamy lamellae in the subsoil and are in landscape positions similar to those of the Gowdy soil

Similar inclusions:

- Areas where the substratum has less clay

Use and Management

Land use: Dominant uses—cropland, pasture; other uses—woodland, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Crop rotations that include grasses and legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: A high shrink-swell potential in the lower part of the subsoil and in the substratum, the instability of cutbanks, slope

Management measures:

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability in the upper part of the subsoil, which causes poor filtering and a hazard of ground-water pollution; slow permeability in the lower part of the subsoil and in the substratum; slope

Management measures:

Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3A
Michigan soil management group: 4/1a

23A—Arkona loamy fine sand, 0 to 3 percent slopes

Setting

Landform: Drainageways on lake plains and ground moraines
Shape of areas: Irregular
Size of areas: 3 to 80 acres

Typical Profile

Surface layer:
0 to 7 inches—very dark gray loamy fine sand
Subsurface layer:
7 to 14 inches—grayish brown fine sand
Subsoil:
14 to 31 inches—dark brown and strong brown, mottled, loose fine sand
31 to 36 inches—reddish brown, mottled, firm silty clay
Substratum:
36 to 60 inches—brown, mottled silty clay

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and very slow in the lower part
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: Perched 1 to 2 feet below the surface from November through May
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Arkona soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Claybanks, Gowdy, and Perrinton soils in the higher landscape positions
- The somewhat poorly drained Del Rey and Nappanee

soils, which are clayey throughout and are in landscape positions similar to those of the Arkona soil

- The very poorly drained Hoytville soils in depressions

Similar inclusions:

- Areas where the substratum has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Seasonal wetness, soil blowing, a low content of organic matter, seasonal droughtiness

Management measures:

- Surface and subsurface drainage systems are needed to reduce the wetness.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Increasing the content of organic matter in the root zone can improve the ability of the soil to hold water, nutrients, and pesticides and reduces the risk of ground-water pollution.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soil is frozen.

Pasture

Major management concerns: Seasonal wetness, seasonal droughtiness, overgrazing

Management measures:

- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Deferred grazing during wet periods helps to keep the pasture in good condition.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: A high shrink-swell potential in subsoil and substratum, seasonal wetness, the instability of cutbanks

Management measures:

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- A surface or subsurface drainage system helps to lower the water table.
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness; rapid permeability in the upper part of the subsoil, which causes poor filtering and a hazard of ground-water pollution; very slow permeability in the lower part of the subsoil and in the substratum

Management measures;

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 2W
Michigan soil management group: 4/1b

24—Sickles loamy sand

Setting

Landform: Depressions and drainageways on lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 3 to 80 acres

Typical Profile

Surface layer:
0 to 9 inches—black loamy sand

Substratum:
9 to 17 inches—grayish brown, mottled sand
17 to 32 inches—grayish brown sand
32 to 60 inches—dark gray, mottled silty clay loam

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and very slow in the lower part
Available water capacity: Low
Drainage class: Poorly drained

Seasonal high water table: 1 foot above to 1 foot below the surface from December through May
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: Moderate

Composition

Sickles soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona and Del Rey soils in the slightly higher landscape positions
- The very poorly drained Lamson soils, which have a stratified substratum and are in landscape positions similar to those of the Sickles soil

Similar inclusions:

- Areas where the surface layer is more than 10 inches thick
- Areas where the clayey part of the substratum is at a depth of 40 to 60 inches

Use and Management

Land use: Dominant uses—woodland, cropland; other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Cropland

Major management concerns: Seasonal wetness, soil blowing, seasonal droughtiness

Management measures:

- Surface and subsurface drainage systems are needed to reduce the wetness.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.

Pasture

Major management concerns: Seasonal wetness, seasonal droughtiness, overgrazing

Management measures:

- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: Ponding, the instability of cutbanks

- Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding, rapid permeability in the subsoil, slow permeability in the substratum

- Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 5W
Michigan soil management group: 4/1c

25B—Gowdy-Perrinton complex, 1 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Gowdy

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsoil:
9 to 28 inches—brown and yellowish brown, loose fine sand
28 to 32 inches—dark brown, firm silty clay loam and pale brown fine sandy loam
32 to 42 inches—strong brown, firm silty clay loam

Substratum:
42 to 60 inches—strong brown silty clay loam

Perrinton

Surface layer:
0 to 9 inches—very dark grayish brown fine sandy loam

Subsoil:
9 to 18 inches—grayish brown fine sandy loam and dark brown, mottled, firm silty clay loam
18 to 35 inches—dark brown silty clay loam and strong brown, firm silty clay

Substratum:
35 to 60 inches—dark brown and yellowish brown silty clay

Soil Properties and Qualities

Permeability: Gowdy—rapid in the upper part of the profile and slow in the lower part; Perrinton—slow
Available water capacity: Gowdy—moderate; Perrinton—high
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Gowdy—very slow; Perrinton—medium
Flooding: None
Hazard of soil blowing: Gowdy—moderate; Perrinton—none

Composition

Gowdy soil and similar soils: 40 to 60 percent
Perrinton soil and similar soils: 35 to 40 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:
- The poorly drained Bono soils in depressions
- The somewhat poorly drained Arkona and Ithaca soils in drainageways and on foot slopes
- The well drained Spinks soils, which are sandy in the lower part of the subsoil and are in landscape positions similar to those of the Gowdy and Perrinton soils

Similar inclusions:
- Areas where the Gowdy soil has less clay in the substratum
- Areas where the Perrinton soil is sandy at a depth of more than 40 inches
- Areas where the subsoil in the Perrinton soil has less clay
- Areas where the Perrinton soil is moderately well drained

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion on both soils; compaction and tilth in the surface layer of the Perrinton soil; soil blowing, seasonal droughtiness, and a low content of organic matter in areas of the Gowdy soil

Management measures:
- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction in areas of the Perrinton soil, seasonal droughtiness in the Gowdy soil, overgrazing on both soils

Management measures:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Shrink-swell potential throughout the Perrinton soil and in the lower part of the subsoil and in the substratum of the Gowdy soil, the instability of cutbanks in areas of the Gowdy soil

Management measures:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability in the upper part of the subsoil of the Gowdy soil, which causes poor filtering and a hazard of ground-water pollution; slow permeability in the Perrinton soil and in the lower part of the subsoil and in the substratum of the Gowdy soil

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Gowdy—3A; Perrinton—4A
Michigan soil management group: Gowdy—4/1a; Perrinton—1.5a

25C—Gowdy-Perrinton complex, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 15 to 120 acres

Typical Profile

Gowdy

Surface layer:
0 to 9 inches—dark brown loamy fine sand
Subsoil:
9 to 28 inches—brown and yellowish brown, loose fine sand
28 to 32 inches—dark brown, firm silty clay loam and pale brown fine sandy loam
32 to 42 inches—strong brown, firm silty clay loam
Substratum:
42 to 60 inches—strong brown silty clay loam

Perrinton

Surface layer:
0 to 9 inches—very dark grayish brown fine sandy loam
Subsurface layer:
9 to 18 inches—grayish brown fine sandy loam and strong brown, mottled, firm silty clay loam
18 to 35 inches—dark brown silty clay loam and strong brown, firm silty clay
Substratum:
35 to 60 inches—dark brown and yellowish brown silty clay

Soil Properties and Qualities

Permeability: Gowdy—rapid in the upper part of the profile and slow in the lower part; Perrinton—slow
Available water capacity: Gowdy—moderate; Perrinton—high
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Gowdy—slow; Perrinton—medium
Flooding: None
Hazard of soil blowing: Gowdy—moderate; Perrinton—none

Composition

Gowdy soil and similar soils: 40 to 60 percent
Perrinton soil and similar soils: 35 to 40 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona and Ithaca soils in depressions and on foot slopes
- The well drained Spinks soils, which are sandy in the lower part of the subsoil and are in landscape positions similar to those of the Gowdy and Perrinton soils

Similar inclusions:

- Areas where the substratum in the Gowdy soil has less clay
- Areas where the Perrinton soil is sandy at a depth of more than 40 inches
- Areas where the subsoil in the Perrinton soil has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion on both soils; tilth in the Perrinton soil; soil blowing, seasonal droughtiness, and a low content of organic matter in the Gowdy soil

Management measures:

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Crop residue management, no-till planting, a cropping sequence that includes grasses and legumes, and minimum tillage help to maintain tilth.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping

sequence, no-till planting, and crop residue management increase the content of organic matter.

- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction in areas of the Perrinton soil, seasonal droughtiness in the Gowdy soil, overgrazing on both soils

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Shrink-swell potential throughout the Perrinton soil and in the lower part of the subsoil and in the substratum of the Gowdy soil, the instability of cutbanks in areas of the Gowdy soil, the slope of both soils

Management measures:

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability in the upper part of the subsoil in the Gowdy soil, which causes poor filtering and a hazard of ground-water pollution; slow permeability in the Perrinton soil and in the lower part of the subsoil and in the substratum of the Gowdy soil

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Gowdy—3A; Perrinton—4A
Michigan soil management group: Gowdy—4/1a; Perrinton—1.5a

25D—Gowdy-Perrinton complex, 12 to 18 percent slopes

Setting

Landform: Hilly areas on end moraines
Shape of areas: Irregular
Size of areas: 15 to 120 acres

Typical Profile

Gowdy

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsoil:
9 to 28 inches—brown and yellowish brown, loose fine sand
28 to 32 inches—dark brown, firm silty clay loam and pale brown fine sandy loam
32 to 42 inches—strong brown, firm silty clay loam

Substratum:
42 to 60 inches—strong brown silty clay loam

Perrinton

Surface layer:
0 to 9 inches—very dark grayish brown fine sandy loam

Subsurface layer:
9 to 18 inches—grayish brown fine sandy loam and strong brown, mottled, firm silty clay loam
18 to 35 inches—dark brown silty clay loam and strong brown, firm silty clay

Substratum:
35 to 60 inches—dark brown and yellowish brown silty clay

Soil Properties and Qualities

Permeability: Gowdy—rapid in the upper part of the profile and slow in the lower part; Perrinton—slow
Available water capacity: Gowdy—moderate; Perrinton—high
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Gowdy—slow; Perrinton—rapid
Flooding: None
Hazard of soil blowing: Gowdy—moderate; Perrinton—none

Composition

Gowdy soil and similar soils: 40 to 60 percent

Perrinton soil and similar soils: 30 to 50 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The well drained Spinks soils, which are sandy in the lower part of the subsoil and are in landscape positions similar to those of the Gowdy and Perrinton soils

Similar inclusions:
- Areas where the substratum in the Gowdy soil has less clay
- Areas where the Perrinton soil is sandy at a depth of more than 40 inches
- Areas where the subsoil in the Perrinton soil has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion on both soils; compaction and tilth in the surface layer of the Perrinton soil; soil blowing, seasonal droughtiness, and a low content of organic matter in areas of the Gowdy soil

Management measures:
- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction in areas of the Perrinton soil, seasonal droughtiness in the Gowdy soil, overgrazing on both soils

Management measures:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Shrink-swell potential throughout the Perrinton soil and in the lower part of the subsoil and in the substratum of the Gowdy soil, the instability of cutbanks in areas of the Gowdy soil, the slope of both soils

Management measures:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- The sides of shallow excavations should be reinforced.
- Because of the slope, these soils are poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Rapid permeability in the upper part of the subsoil in the Gowdy soil, which causes poor filtering and a hazard of ground-water pollution; slow permeability in the Perrinton soil and in the lower part of the subsoil in the Gowdy soil; the slope of both soils

Management measures:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: Gowdy—3A; Perrinton—4A
Michigan soil management group: Gowdy—4/1a; Perrinton—1.5a

25E—Gowdy-Perrinton complex, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines

Shape of areas: Irregular or elongated
Size of areas: 5 to 100 acres

Typical Profile

Gowdy

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsoil:
9 to 28 inches—brown and yellowish brown, loose fine sand
28 to 32 inches—dark brown, firm silty clay loam and pale brown fine sandy loam
32 to 42 inches—strong brown, firm silty clay loam

Substratum:
42 to 60 inches—strong brown silty clay loam

Perrinton

Surface layer:
0 to 9 inches—very dark grayish brown fine sandy loam

Subsurface layer:
9 to 18 inches—grayish brown fine sandy loam and strong brown, mottled, firm silty clay loam
18 to 35 inches—dark brown silty clay loam and strong brown, firm silty clay

Substratum:
35 to 60 inches—dark brown and yellowish brown silty clay

Soil Properties and Qualities

Permeability: Gowdy—rapid in the upper part of the profile and slow in the lower part; Perrinton—slow
Available water capacity: Gowdy—moderate; Perrinton—high
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Gowdy—moderate; Perrinton—none

Composition

Gowdy soil and similar soils: 40 to 60 percent
Perrinton soil and similar soils: 30 to 50 percent

Inclusions

Similar inclusions:

- Areas where the substratum in the Gowdy soil has less clay
- Areas where the Perrinton soil is sandy at a depth of more than 40 inches
- Areas where the subsoil in the Perrinton soil has less clay

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation

Management measures:

- Because of the erosion hazard, logging roads and skid trails should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.

Buildings

Major management concerns: Shrink-swell potential throughout the Perrinton soil and in the lower part of the subsoil and in the substratum of the Gowdy soil, the instability of cutbanks in areas of the Gowdy soil, the slope of both soils

- Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Rapid permeability in the upper part of the subsoil in the Gowdy soil, slow permeability in the Perrinton soil and in the lower part of the subsoil and in the substratum of the Gowdy soil, the slope of both soils

- Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: Gowdy—3R; Perrinton—4R
Michigan soil management group: Gowdy—4/1a; Perrinton—1.5a

26A—Arkona-Ithaca complex, 0 to 3 percent slopes

Setting

Landform: Drainageways on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 250 acres

Typical Profile

Arkona

Surface layer:
0 to 7 inches—very dark gray loamy fine sand

Subsurface layer:
7 to 14 inches—grayish brown fine sand

Subsoil:
14 to 31 inches—dark brown and strong brown, mottled, loose fine sand
31 to 36 inches—reddish brown, firm silty clay

Substratum:
36 to 60 inches—brown, mottled silty clay

Ithaca

Surface layer:
0 to 9 inches—very dark gray loam

Subsoil:
9 to 13 inches—pale brown fine sandy loam and dark brown, firm clay loam
13 to 24 inches—dark brown, mottled, firm clay loam
24 to 60 inches—dark yellowish brown and brown, mottled clay loam

Soil Properties and Qualities

Permeability: Arkona—rapid in the upper part of the profile and very slow in the lower part; Ithaca—slow
Available water capacity: Arkona—low; Ithaca—high
Drainage class: Somewhat poorly drained
Seasonal high water table: Arkona—perched 1 to 2 feet below the surface from November through May; Ithaca—1 to 2 feet below the surface from October through May
Surface runoff: Arkona—very slow; Ithaca—medium
Flooding: None
Hazard of soil blowing: Arkona—moderate; Ithaca—none

Composition

Arkona soil and similar soils: 40 to 60 percent
Ithaca soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The poorly drained Bono soils in depressions
- The well drained Marlette, Perrinton, and Gowdy soils in the higher landscape positions

Similar inclusions:

- Areas where the subsoil in the Ithaca soil has more clay
- Areas where the substratum in the Ithaca soil is sandy or stratified
- Areas where the subsoil in the Ithaca soil has less clay
- Areas of the Arkona soil in which the lower part of the subsoil and all of the substratum have less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Seasonal wetness in both soils; water erosion, slow permeability, compaction, and tilth in areas of the Ithaca soil; soil blowing, seasonal droughtiness, and a low content of organic matter in areas of the Arkona soil

Management measures:

- Surface and subsurface drainage systems are needed to reduce the wetness.
- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Because of slow permeability, subsurface drains should be closely spaced.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Increasing the content of organic matter in the root zone can improve the ability of the soils to hold water, nutrients, and pesticides and reduces the risk of ground-water pollution.

Woodland

Major management concerns: Equipment limitation

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soils are frozen.
- Trees that can withstand seasonal wetness should be selected for planting.

Pasture

Major management concerns: Compaction in areas of the Ithaca soil, seasonal wetness and overgrazing on both soils, seasonal droughtiness in the Arkona soil

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates, controlled grazing, and

restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: Seasonal wetness in both soils, shrink-swell potential in the lower part of the subsoil and in the substratum of the Arkona soil, the instability of cutbanks in areas of the Arkona soil

Management measures:

- A surface or subsurface drainage system helps to lower the water table.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- The sides of shallow excavations in areas of the Arkona soil should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness in both soils; slow permeability in the Ithaca soil and very slow permeability in the lower part of the subsoil and in the substratum of the Arkona soil; rapid permeability in the upper part of the subsoil in the Arkona soil, which causes poor filtering and a hazard of ground-water pollution

Management measures:

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: Arkona—2W; Ithaca—4W
Michigan soil management group: Arkona—4/1b; Ithaca—1.5b

27B—Arkona-Del Rey complex, 0 to 4 percent slopes

Setting

Landform: Drainageways on lake plains
Shape of areas: Irregular
Size of areas: 10 to 1,200 acres

Typical Profile

Arkona

Surface layer:
0 to 7 inches—very dark gray loamy fine sand

Subsurface layer:
7 to 14 inches—grayish brown fine sand

Subsoil:
14 to 31 inches—dark brown and strong brown, mottled, loose fine sand
31 to 36 inches—reddish brown, firm silty clay

Substratum:
36 to 60 inches—brown, mottled silty clay

Del Rey

Surface layer:
0 to 8 inches—very dark grayish brown silt loam

Subsoil:
8 to 32 inches—brown and yellowish brown, mottled, firm silty clay loam
32 to 60 inches—yellowish brown, mottled silt loam

Soil Properties and Qualities

Permeability: Arkona—rapid in the upper part of the profile and very slow in the lower part; Del Rey—slow
Available water capacity: Arkona—low; Del Rey—moderate
Drainage class: Somewhat poorly drained
Seasonal high water table: Arkona—perched 1 to 2 feet below the surface from November through May; Del Rey—1 to 3 feet below the surface from January through May
Surface runoff: Arkona—very slow; Del Rey—medium
Flooding: None
Hazard of soil blowing: Arkona—moderate; Del Rey—none

Composition

Arkona soil and similar soils: 40 to 65 percent
Del Rey soil and similar soils: 20 to 45 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:

- The poorly drained Bono and Lamson soils in depressions
- The well drained Grattan soils that have a loamy substratum and the well drained Gowdy soils in the higher landscape positions

Similar inclusions:

- Areas where the subsoil of the Arkona soil is sandy and is less than 20 inches thick
- Areas where the substratum in the Del Rey soil is sandy

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Seasonal wetness in both soils; water erosion, slow permeability, compaction, and tilth in areas of the Del Rey soil; soil blowing, seasonal droughtiness, and a low content of organic matter in areas of the Arkona soil

Management measures:

- Surface and subsurface drainage systems are needed to reduce the wetness.
- Subsurface drainage systems should be designed so that the rate of flowing water helps to keep fine sand and silt from plugging the tile lines. Also, suitable filtering material may be needed to keep the silt and fine sand from flowing into the tile lines.
- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Because of restricted permeability, subsurface drains should be closely spaced.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Including grasses and legumes in the cropping sequence can reduce nutrient losses, improve soil structure, and provide nitrogen for use by succeeding crops.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Increasing the content of organic matter in the root zone can improve the ability of the soils to hold water, nutrients, and pesticides and reduces the risk of ground-water pollution.

Woodland

Major management concerns: Equipment limitation on both soils, seedling mortality and windthrow hazard on the Del Rey soil

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soils are frozen.
- Because of the restricted permeability and the sticky subsoil, logging roads should be gravelly and in some areas landings should be stabilized.
- Special site preparation, such as bedding before planting, can reduce the seedling mortality rate.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Compaction in areas of the Del Rey soil, seasonal wetness and overgrazing on both soils, seasonal droughtiness in the Arkona soil

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: Seasonal wetness in both soils, shrink-swell potential in the upper part of the subsoil in the Arkona soil, the instability of cutbanks in areas of the Arkona soil

Management measures:

- A surface or subsurface drainage system helps to lower the water table.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- The sides of shallow excavations in areas of the Arkona soil should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness in both soils; very slow permeability in the lower part of the subsoil and in the substratum of the Arkona soil; rapid permeability in the upper part of the subsoil in the Arkona soil, which causes poor filtering and a hazard of ground-water pollution

Management measures:

- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: Arkona—2W; Del Rey—3C
Michigan soil management group: Arkona—4/1b; Del Rey—1.5b

28B—Fern loamy fine sand, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 320 acres

Typical Profile

Surface layer:
0 to 10 inches—dark brown loamy fine sand

Subsoil:
10 to 21 inches—brown, friable loamy fine sand
21 to 30 inches—pale brown loamy fine sand and dark brown, friable loam
30 to 51 inches—reddish brown, friable clay loam and pale brown loamy fine sand
51 to 60 inches—dark brown, friable loam

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Fern soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona soils in drainageways and on foot slopes
- The well drained Marlette and Remus soils, which are loamy throughout and are in landscape positions similar to those of the Fern soil
- The well drained Spinks soils, which are sandy throughout and are in landscape positions similar to those of the Fern soil

Similar inclusions:

- Areas where the soil has a clayey substratum
- Areas where the soil has a sandy substratum
- Areas where the subsoil has more clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Drought-tolerant crops should be selected for planting. Otherwise, irrigation is needed.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Moderate permeability

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4S
Michigan soil management group: 4/2a

28C—Fern loamy fine sand, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 120 acres

Typical Profile

Surface layer:
0 to 10 inches—dark brown loamy fine sand

Subsoil:
10 to 21 inches—brown, friable loamy fine sand
21 to 30 inches—pale brown loamy fine sand and dark brown, friable loam
30 to 51 inches—reddish brown, friable clay loam and pale brown loamy fine sand
51 to 60 inches—dark brown, friable loam

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Fern soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona soils in drainageways and on foot slopes
- The well drained Marlette and Remus soils, which are loamy throughout and are in landscape positions similar to those of the Fern soil
- The well drained Spinks soils, which are sandy throughout and are in landscape positions similar to those of the Fern soil

Similar inclusions:

- Areas where the soil has a clayey substratum
- Areas where the soil has a sandy substratum
- Areas where the subsoil has more clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Drought-tolerant crops should be selected for planting. Otherwise, irrigation is needed.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Moderate permeability, slope

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4S
Michigan soil management group: 4/2a

28D—Fern loamy fine sand, 12 to 18 percent slopes

Setting

Landform: Hilly areas on ground moraines and end moraines
Shape of areas: Irregular
Size of areas: 3 to 80 acres

Typical Profile

Surface layer:
0 to 10 inches—dark brown loamy fine sand

Subsoil:
10 to 21 inches—brown, friable loamy fine sand
21 to 30 inches—pale brown loamy fine sand and dark brown, friable loam
30 to 51 inches—reddish brown, friable clay loam and pale brown loamy fine sand
51 to 60 inches—dark brown, friable loam

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Fern soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The well drained Marlette and Remus soils, which are loamy throughout and are in landscape positions similar to those of the Fern soil
- The well drained Spinks soils, which are sandy throughout and are in landscape positions similar to those of the Fern soil

Similar inclusions:

- Areas where the soil has a clayey substratum
- Areas where the soil has a sandy substratum
- Areas where the subsoil has more clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Water erosion can be controlled by diversions, crop residue management, contour stripcropping, field stripcropping, cover crops, grassed waterways, conservation tillage, crop rotations that include grasses and legumes, grade stabilization structures, or a combination of these.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Drought-tolerant crops should be selected for planting. Otherwise, irrigation is needed.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control

runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Moderate permeability, slope

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 4S
Michigan soil management group: 4/2a

29A—Dixboro loamy very fine sand, 0 to 3 percent slopes

Setting

Landform: Drainageways on lake plains and glacial deltas
Shape of areas: Irregular
Size of areas: 3 to 100 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark gray loamy very fine sand

Subsoil:
9 to 14 inches—dark yellowish brown, mottled, friable very fine sandy loam
14 to 24 inches—yellowish brown, mottled, friable loamy very fine sand

Substratum:
24 to 60 inches—pale brown, mottled, stratified very fine sandy loam, loamy very fine sand, and silt loam

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Seasonal high water table: 1 to 2 feet below the surface from November through April
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Dixboro soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Altmar soils, which have sand and gravel at a depth of 20 to 40 inches and are in landscape positions similar to those of the Dixboro soil
- The very poorly drained Lamson soils in depressions
- The somewhat poorly drained Pipestone soils, which are sandy throughout and are in landscape positions similar to those of the Dixboro soil

Similar inclusions:

- Areas where the subsoil has less clay

Use and Management

Land use: Dominant uses—cropland, pasture; other uses—woodland, building site development

Cropland

Major management concerns: Seasonal wetness, compaction, tilth in the surface layer

Management measures:

- Surface and subsurface drainage systems are needed to reduce the wetness.
- Subsurface drainage systems should be designed so that the rate of flowing water helps to keep fine sand and silt from plugging the tile lines. Also, suitable

filtering material may be needed to keep the silt and fine sand from flowing into the tile lines.

- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Increasing the content of organic matter in the root zone can improve the ability of the soil to hold water, nutrients, and pesticides and reduces the risk of ground-water pollution.

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

Woodland

Major management concerns: Equipment limitation, seasonal wetness

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Trees that can withstand seasonal wetness should be selected for planting.

Buildings

Major management concerns: Seasonal wetness, the instability of cutbanks

Management measures:

- A surface or subsurface drainage system helps to lower the water table.
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness

Management measures:

- Mounding or adding suitable fill material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IIw
Woodland ordination symbol: 4W
Michigan soil management group: 3b-s

30—Lamson muck

Setting

Landform: Depressions on lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular or elongated
Size of areas: 3 to 35 acres

Typical Profile

Surface layer:
0 to 9 inches—black muck

Subsoil:
9 to 15 inches—light brownish gray, mottled, friable fine sand
15 to 22 inches—brown, mottled, very friable loamy very fine sand
22 to 42 inches—gray, mottled, firm silt loam

Substratum:
42 to 80 inches—gray, stratified very fine sand, loamy very fine sand, and silt

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: High
Drainage class: Very poorly drained
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface from December through May
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: Moderate

Composition

Lamson soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Dixboro and Freesoil soils in the slightly higher landscape positions
- The poorly drained Granby and Kingsville soils, which are sandy throughout and are in landscape positions similar to those of the Lamson soil

Similar inclusions:

- Areas where the substratum is sandy
- Areas where the subsoil has more clay
- Areas where the surface layer is more than 10 inches thick

Use and Management

Land use: Dominant uses—woodland, pasture; other uses—cropland, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness, overgrazing

Management measures:

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.

Cropland

Major management concerns: Seasonal wetness, soil blowing

Management measures:

- Surface and subsurface drainage systems are needed to reduce the wetness, but subsurface drains require a suitable outlet.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.

Buildings

Major management concerns: Ponding, the instability of cutbanks

- Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding

- Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 8W
Michigan soil management group: 3c-s

35B—Alvin-Spinks complex, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on outwash plains
Shape of areas: Irregular
Size of areas: 10 to 150 acres

Typical Profile

Alvin

Surface layer:
0 to 8 inches—very dark grayish brown fine sandy loam

Subsurface layer:
8 to 15 inches—yellowish brown fine sandy loam

Subsoil:
15 to 22 inches—strong brown, friable fine sandy loam
22 to 31 inches—pale brown and strong brown, friable fine sandy loam
31 to 80 inches—pale brown, loose sand that has lamellae of dark brown, friable loamy sand

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Alvin—moderate; Spinks—low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Alvin—medium; Spinks—very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Alvin soil and similar soils: 35 to 50 percent
Spinks soil and similar soils: 45 to 50 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Arkport soils, which are stratified in the lower part of the subsoil and are in landscape positions similar to those of the Alvin and Spinks soils
- The somewhat poorly drained Thetford soils in drainageways and on foot slopes

Similar inclusions:
- Areas where the subsoil in the Alvin soil has more clay
- Areas where the subsoil in the Spinks soil has less than 6 inches of lamellae
- Areas where the lower part of the subsoil and all of the substratum in the Spinks soil have 15 or more percent gravel

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, compaction, and tilth in the surface layer in areas of the Alvin soil; soil blowing on both soils; seasonal droughtiness and a low content of organic matter in the Spinks soil

Management measures:
- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness in the Spinks soil, overgrazing on both soils, compaction in areas of the Alvin soil

Management measures:
- Proper stocking rates, controlled grazing, pasture rotation, timely deferment of grazing, and restricted use during dry periods and during wet periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: None

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: Alvin—5A; Spinks—4A
Michigan soil management group: Alvin—3/5a; Spinks—4a

35C—Alvin-Spinks complex, 6 to 12 percent slopes

Setting

Landform: Rolling areas on outwash plains and terraces
Shape of areas: Irregular
Size of areas: 10 to 175 acres

Typical Profile

Alvin

Surface layer:
0 to 8 inches—very dark grayish brown fine sandy loam

Subsurface layer:
8 to 15 inches—yellowish brown fine sandy loam

Subsoil:
15 to 22 inches—strong brown, friable fine sandy loam
22 to 31 inches—pale brown and strong brown, friable fine sandy loam
31 to 80 inches—pale brown, loose sand that has lamellae of dark brown, friable loamy sand

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Alvin—moderate; Spinks—low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches

Surface runoff: Alvin—medium; Spinks—slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Alvin soil and similar soils: 35 to 50 percent
Spinks soil and similar soils: 45 to 50 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Arkport soils, which are stratified in the lower part of the subsoil and are in landscape positions similar to those of the Alvin and Spinks soils

Similar inclusions:

- Areas where the subsoil in the Alvin soil has more clay
- Areas where the subsoil in the Spinks soil has less than 6 inches of lamellae
- Areas where the lower part of the subsoil and all of the substratum in the Spinks soil have 15 or more percent gravel

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion and soil blowing on both soils, compaction and tilth in the surface layer in areas of the Alvin soil, seasonal droughtiness and a low content of organic matter in the Spinks soil

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness in the Spinks soil, overgrazing on both soils, compaction in areas of the Alvin soil

Management measures:

- Proper stocking rates, controlled grazing, pasture rotation, timely deferment of grazing, and restricted use during dry periods and during wet periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Slope

Management measures:

- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Alvin—5A; Spinks—4A
Michigan soil management group: Alvin—3/5a; Spinks—4a

35D—Alvin-Spinks complex, 12 to 18 percent slopes

Setting

Landform: Hilly areas on outwash plains and terraces
Shape of areas: Irregular
Size of areas: 10 to 175 acres

Typical Profile

Alvin

Surface layer:
0 to 8 inches—very dark grayish brown fine sandy loam

Subsurface layer:
8 to 15 inches—yellowish brown fine sandy loam

Subsoil:
15 to 22 inches—strong brown, friable fine sandy loam
22 to 31 inches—pale brown and strong brown, friable fine sandy loam
31 to 80 inches—pale brown, loose sand that has lamellae of dark brown, friable loamy sand

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown fine sand

Subsoil:
9 to 18 inches—strong brown, very friable loamy fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Alvin—moderate; Spinks—low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Alvin—rapid; Spinks—slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Alvin soil and similar soils: 35 to 45 percent
Spinks soil and similar soils: 45 to 50 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Arkport soils, which are stratified in the lower part of the subsoil and are in landscape positions similar to those of the Alvin and Spinks soils

Similar inclusions:

- Areas where the subsoil in the Alvin soil has more clay
- Areas where the subsoil in the Spinks soil has less than 6 inches of lamellae
- Areas where the lower part of the subsoil and all of the substratum in the Spinks soil have 15 or more percent gravel

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion and soil blowing on both soils, compaction and tilth in the surface layer in areas of the Alvin soil, seasonal droughtiness and a low content of organic matter in the Spinks soil

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness in the Spinks soil, overgrazing on both soils, compaction in areas of the Alvin soil

Management measures:

- Proper stocking rates, controlled grazing, pasture rotation, timely deferment of grazing, and restricted use during dry periods and during wet periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:
- The sides of shallow excavations should be reinforced.
- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Slope

Management measures:
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Alvin—5A; Spinks—4A
Michigan soil management group: Alvin—3/5a; Spinks—4a

36A—Del Rey silt loam, 0 to 3 percent slopes

Setting

Landform: Drainageways on lake plains
Shape of areas: Irregular
Size of areas: 3 to 225 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark grayish brown silt loam

Subsoil:
8 to 32 inches—brown and yellowish brown, mottled, firm silty clay loam
32 to 60 inches—yellowish brown, mottled silt loam

Soil Properties and Qualities

Permeability: Slow
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Seasonal high water table: 1 to 3 feet below the surface from January through May
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Moderate

Composition

Del Rey soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Arkona soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Del Rey soil
- The poorly drained Bono and Sickles soils in depressions

Similar inclusions:
- Areas where the subsoil has less clay
- Areas of soils that have a sandy substratum

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Seasonal wetness, water erosion, slow permeability, tilth in the surface layer, compaction

Management measures:
- Surface and subsurface drainage systems are needed to reduce the wetness.
- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Because of restricted permeability, subsurface drains should be closely spaced.
- Subsurface drainage systems should be designed so that the rate of flowing water helps to keep fine sand and silt from plugging the tile lines. Also, suitable filtering material may be needed to keep the silt and fine sand from flowing into the tile lines.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soil is frozen.
- Because of the slow permeability and the sticky subsoil, logging roads should be gravelly and in some areas landings should be stabilized.
- Special site preparation, such as bedding before planting, can reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Proper stocking rates and a planned grazing system help to keep the pasture in good condition.

Buildings

Major management concerns: Seasonal wetness

Management measures:
- Buildings can be constructed on well compacted fill material that raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Seasonal wetness, slow permeability

Management measures:
- Mounding or adding suitable fill material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIw
Woodland ordination symbol: 3C
Michigan soil management group: 1.5b

37A—Altmar loamy fine sand, 0 to 3 percent slopes

Setting

Landform: Drainageways on outwash plains and valley trains
Shape of areas: Irregular
Size of areas: 10 to 120 acres

Typical Profile

Surface layer:
0 to 9 inches—black loamy fine sand

Subsoil:
9 to 24 inches—yellowish brown and strong brown, mottled, very friable loamy sand

Substratum:
24 to 60 inches—brown, mottled gravelly sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: 1 to 2 feet below the surface from November through May
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Altmar soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The poorly drained Granby soils in depressions
- The well drained Okee and Toogood soils in the higher landscape positions

Similar inclusions:
- Areas where the subsoil has more clay

Use and Management

Land use: Dominant uses—cropland, pasture; other uses—woodland, building site development

Cropland

Major management concerns: Seasonal wetness, soil blowing, seasonal droughtiness

Management measures:
- Surface and subsurface drainage systems are needed to reduce the wetness.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Pasture

Major management concerns: Seasonal wetness, seasonal droughtiness, overgrazing

Management measures:
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Proper stocking rates, a planned grazing system, controlled grazing, restricted use during dry periods, and deferred grazing during wet periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soil is frozen.

Buildings

Major management concerns: Seasonal wetness, the instability of cutbanks

Management measures:

- A surface or subsurface drainage system helps to lower the water table.
- Buildings can be constructed on well compacted fill material that raises the site a sufficient distance above the water table.
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness; rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Management measures:

- A subsurface drainage system helps to lower the water table.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IVw
Woodland ordination symbol: 3W
Michigan soil management group: 4b

38B—Spinks-Okee complex, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 15 to 280 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Okee

Surface layer:
0 to 3 inches—black loamy sand

Subsoil:
3 to 25 inches—strong brown, very friable loamy sand
25 to 33 inches—dark brown, friable sandy loam

Substratum:
33 to 40 inches—pale brown very gravelly sand
40 to 60 inches—pale brown, stratified sand and gravel

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Okee—moderate in the upper part of the profile and moderately rapid in the lower part
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 60 percent
Okee soil and similar soils: 25 to 35 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Altmar and Thetford soils in depressions and swales on foot slopes
- The excessively drained Benona soils, which have less than 6 inches of lamellae and are in landscape positions similar to those of the Spinks and Okee soils
- The well drained Remus soils, which are loamy throughout and are in landscape positions similar to those of the Spinks and Okee soils

Similar inclusions:

- Areas where the subsoil has less than 6 inches of lamellae
- Areas where the subsoil has lamellae with more clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.

- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Drought-tolerant crops should be selected for planting. Otherwise, irrigation is needed.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Moderate permeability in the upper part of the Okee soil; moderately rapid permeability in the lower part, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: Spinks—4A; Okee—2A
Michigan soil management group: Spinks—4a; Okee—4/2a

38C—Spinks-Okee complex, 6 to 12 percent slopes

Setting

Landform: Rolling areas on end moraines and ground moraines
Shape of areas: Irregular
Size of areas: 15 to 100 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown fine sand

Subsoil:
9 to 18 inches—strong brown, very friable loamy fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Okee

Surface layer:
0 to 3 inches—black loamy sand

Subsoil:
3 to 25 inches—strong brown, very friable loamy sand
25 to 33 inches—dark brown, friable sandy loam

Substratum:
33 to 40 inches—pale brown very gravelly sand
40 to 60 inches—pale brown, stratified sand and gravel

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Okee—moderate in the upper part of the profile and moderately rapid in the lower part
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 60 percent
Okee soil and similar soils: 25 to 35 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:

- The excessively drained Benona soils, which have less than 6 inches of sandy lamellae and are in landscape positions similar to those of the Spinks and Okee soils
- The well drained Remus soils, which are loamy throughout and are in landscape positions similar to those of the Spinks and Okee soils

Similar inclusions:

- Areas where the subsoil has less than 6 inches of lamellae
- Areas where the subsoil has lamellae with more clay

Use and Management

Land use: Dominant uses—cropland, woodland; other

uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Drought-tolerant crops should be selected for planting. Otherwise, irrigation is needed.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Moderately rapid permeability in the Okee soil, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Spinks—4A; Okee—2A
Michigan soil management group: Spinks—4a; Okee—4/2a

38D—Spinks-Okee complex, 12 to 18 percent slopes

Setting

Landform: Hilly areas on end moraines and ground moraines
Shape of areas: Irregular
Size of areas: 10 to 120 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Okee

Surface layer:
0 to 3 inches—black loamy sand

Subsoil:
3 to 25 inches—strong brown, very friable loamy sand
25 to 33 inches—dark brown, friable sandy loam

Substratum:
33 to 40 inches—pale brown very gravelly sand
40 to 60 inches—pale brown, stratified sand and gravel

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Okee—moderate in the upper part of the profile and moderately rapid in the lower part
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 60 percent
Okee soil and similar soils: 25 to 35 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:

- The excessively drained Benona soils, which have less than 6 inches of sandy lamellae and are in landscape positions similar to those of the Spinks and Okee soils
- The well drained Remus soils, which are loamy throughout and are in landscape positions similar to those of the Spinks and Okee soils

Similar inclusions:

- Areas where the subsoil has less than 6 inches of lamellae
- Areas where the subsoil has lamellae with more clay

Use and Management

Land use: Dominant uses—woodland, cropland; other uses—pasture, building site development

Woodland

Major management concerns: Erosion hazard on both soils, equipment limitation on the Okee soil

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Drought-tolerant crops should be selected for planting. Otherwise, irrigation is needed.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Because of the slope, these soils are poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Moderately rapid permeability in the Okee soil, which causes poor filtering and a hazard of ground-water pollution; the slope of both soils

Management measures:

- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Spinks—4A; Okee—2A
Michigan soil management group: 4a

38E—Spinks-Okee complex, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines
Shape of areas: Irregular or elongated
Size of areas: 10 to 45 acres

Typical Profile

Spinks

Surface layer:

0 to 9 inches—very dark grayish brown fine sand

Subsoil:

9 to 18 inches—strong brown, very friable loamy fine sand

18 to 24 inches—brown, loose fine sand

24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Okee

Surface layer:

0 to 3 inches—black loamy sand

Subsoil:

3 to 25 inches—strong brown, very friable loamy sand

25 to 33 inches—dark brown, friable sandy loam

Substratum:

33 to 40 inches—pale brown very gravelly sand

40 to 60 inches—pale brown, stratified sand and gravel

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Okee—moderate in the upper part of the profile and moderately rapid in the lower part

Available water capacity: Low

Drainage class: Well drained

Seasonal high water table: At a depth of more than 60 inches

Surface runoff: Rapid

Flooding: None

Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 65 percent

Okee soil and similar soils: 30 to 35 percent

Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:

- The excessively drained Benona soils, which have less than 6 inches of sandy lamellae and are in landscape positions similar to those of the Spinks and Okee soils
- The well drained Remus soils, which are loamy throughout and are in landscape positions similar to those of the Spinks and Okee soils

Similar inclusions:

- Areas where the lamellae have more clay

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation

- Because of the erosion hazard, logging roads and skid trails should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.

Buildings

Major management concerns: Slope, the instability of cutbanks

- Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: The slope of both soils; moderate permeability in the upper part of the Okee soil and moderately rapid permeability in the lower part

- Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe

Woodland ordination symbol: Spinks—4R; Okee—2R

Michigan soil management group: Spinks—4a; Okee—4/2a

40B—Coloma-Toogood complex, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on outwash plains

Shape of areas: Irregular

Size of areas: 10 to 150 acres

Typical Profile

Coloma

Surface layer:

0 to 4 inches—very dark grayish brown sand

Subsoil:

4 to 35 inches—yellowish brown and brownish yellow, loose sand

35 to 60 inches—light yellowish brown, loose sand that has lamellae of dark brown loamy sand

Toogood

Surface layer:

0 to 9 inches—very dark grayish brown loamy sand

Subsoil:

9 to 25 inches—strong brown, very friable loamy sand

25 to 36 inches—strong brown, loose sand

36 to 38 inches—dark brown, friable gravelly sandy loam

Substratum:
38 to 60 inches—light yellowish brown, stratified gravelly loamy sand and sand

Soil Properties and Qualities

Permeability: Coloma—rapid; Toogood—rapid in the upper part of the profile and very rapid in the lower part
Available water capacity: Low
Drainage class: Coloma—excessively drained; Toogood—somewhat excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Coloma—severe; Toogood—moderate

Composition

Coloma soil and similar soils: 40 to 60 percent
Toogood soil and similar soils: 40 to 50 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Thetford soils in depressions and on foot slopes

Similar inclusions:
- Areas where the subsoil in the Coloma soil has sandy or loamy lamellae with a total thickness of more than 6 inches
- Areas where the subsoil in the Toogood soil has a loamy layer more than 3 inches thick

Use and Management

Land use: Dominant uses—cropland, pasture: other uses—woodland, building site development

Cropland

Major management concerns: Soil blowing, water erosion, seasonal droughtiness, a low content of organic matter

Management measures:
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Because of the limited available water capacity, most crops should be irrigated.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation on both soils, seedling mortality on the Coloma soil

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The instability of cutbanks

Management measures:
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid or very rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: Coloma—2S; Toogood—6A
Michigan soil management group: Coloma—5a; Toogood—4/Ga

40C—Coloma-Toogood complex, 6 to 12 percent slopes

Setting

Landform: Rolling areas on end moraines and outwash plains

Shape of areas: Irregular
Size of areas: 10 to 150 acres

Typical Profile

Coloma

Surface layer:
0 to 4 inches—very dark grayish brown sand

Subsoil:
4 to 35 inches—yellowish brown and brownish yellow, loose sand
35 to 60 inches—light yellowish brown, loose sand that has lamellae of dark brown loamy sand

Toogood

Surface layer:
0 to 9 inches—very dark grayish brown loamy sand

Subsoil:
9 to 25 inches—strong brown, very friable loamy sand
25 to 36 inches—strong brown, loose sand
36 to 38 inches—dark brown, friable gravelly sandy loam

Substratum:
38 to 60 inches—light yellowish brown, stratified gravelly loamy sand and sand

Soil Properties and Qualities

Permeability: Coloma—rapid; Toogood—rapid in the upper part of the profile and very rapid in the lower part
Available water capacity: Low
Drainage class: Coloma—excessively drained; Toogood—somewhat excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Coloma—severe; Toogood—moderate

Composition

Coloma soil and similar soils: 40 to 60 percent
Toogood soil and similar soils: 40 to 60 percent

Inclusions

Similar inclusions:
- Areas where the subsoil in the Coloma soil has sandy or loamy lamellae with a total thickness of more than 6 inches
- Areas where the subsoil in the Toogood soil has a loamy layer more than 3 inches thick

Use and Management

Land use: Dominant uses—cropland, pasture: other uses—woodland, building site development

Cropland

Major management concerns: Soil blowing, water erosion, seasonal droughtiness, a low content of organic matter

Management measures:
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Because of the limited available water capacity, most crops should be irrigated.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Woodland

Major management concerns: Equipment limitation on both soils, seedling mortality on the Coloma soil

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:
- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to

the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid or very rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: Coloma—2S; Toogood—6A
Michigan soil management group: Coloma—5a; Toogood—4/Ga

40D—Coloma-Toogood complex, 12 to 18 percent slopes

Setting

Landform: Hilly areas on end moraines
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Coloma

Surface layer:
0 to 4 inches—very dark grayish brown sand

Subsoil:
4 to 35 inches—yellowish brown and brownish yellow, loose sand
35 to 60 inches—light yellowish brown, loose sand that has lamellae of dark brown loamy sand

Toogood

Surface layer:
0 to 9 inches—very dark grayish brown loamy sand

Subsoil:
9 to 25 inches—strong brown, very friable loamy sand
25 to 36 inches—strong brown, loose sand
36 to 38 inches—dark brown, friable gravelly sandy loam

Substratum:
38 to 60 inches—light yellowish brown, stratified gravelly loamy sand and sand

Soil Properties and Qualities

Permeability: Coloma—rapid; Toogood—rapid in the upper part of the profile and very rapid in the lower part
Available water capacity: Low
Drainage class: Coloma—excessively drained; Toogood—somewhat excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Coloma—severe; Toogood—moderate

Composition

Coloma soil and similar soils: 40 to 60 percent
Toogood soil and similar soils: 40 to 60 percent

Inclusions

Similar inclusions:

- Areas where the subsoil in the Coloma soil has sandy or loamy lamellae with a total thickness of more than 6 inches
- Areas where the subsoil in the Toogood soil has a loamy layer more than 3 inches thick

Use and Management

Land use: Dominant uses—woodland, pasture: other use—building site development

Woodland

Major management concerns: Erosion hazard and equipment limitation on both soils, seedling mortality on the Coloma soil

Management measures:

- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: Slope, the instability of cutbanks

Management measures:

- Because of the slope, these soils are poorly suited to building site development without extensive land shaping.

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Slope; rapid or very rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Management measures:

- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: Coloma—2S; Toogood—6A
Michigan soil management group: Coloma—5a; Toogood—4/Ga

41—Granby mucky loamy sand, gravelly substratum

Setting

Landform: Depressions on outwash plains
Slope: 0 to 2 percent
Shape of areas: Irregular or elongated
Size of areas: 3 to 90 acres

Typical Profile

Surface layer:
0 to 10 inches—black mucky loamy sand
Substratum:
10 to 28 inches—pale brown and light brownish gray, loose sand
28 to 60 inches—very dark grayish brown gravelly sand

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and very rapid in the lower part
Available water capacity: Low
Drainage class: Poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from November through June
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: Moderate

Composition

Granby soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Pipestone soils in the slightly higher landscape positions

Similar inclusions:

- Areas where the surface layer is less than 10 inches thick

Use and Management

Land use: Dominant uses—woodland, pasture; other use—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soil is frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness, seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: Ponding, the instability of cutbanks

- Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding; rapid or very rapid permeability, which causes poor filtering and a hazard of ground-water pollution

- Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 2W
Michigan soil management group: 5c

42B—Spinks-Remus-Fern complex, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 20 to 425 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Remus

Surface layer:
0 to 9 inches—very dark grayish brown fine sandy loam

Subsoil:
9 to 21 inches—pale brown loamy sand and dark brown, friable loam
21 to 50 inches—dark reddish brown and brown, firm loam and sandy clay loam

Substratum:
50 to 60 inches—brown sandy clay loam

Fern

Surface layer:
0 to 10 inches—dark brown loamy fine sand

Subsoil:
10 to 21 inches—brown, friable loamy fine sand
21 to 30 inches—pale brown loamy fine sand and dark brown, friable loam
30 to 51 inches—reddish brown, friable clay loam and pale brown loamy fine sand
51 to 60 inches—dark brown, friable loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Remus—moderately slow; Fern—rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Spinks—low; Remus and Fern—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Spinks and Fern—very slow; Remus—medium
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 35 to 60 percent
Remus soil and similar soils: 20 to 50 percent
Fern soil and similar soils: 15 to 25 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Arkona soils in depressions and on foot slopes
- The very poorly drained Bono and Lamson soils in depressions

Similar inclusions:
- Areas where the subsoil in the Spinks soil has less than 6 inches of loamy lamellae
- Areas where the subsoil in the Remus soil has more clay
- Areas where the subsoil in the Remus soil has less clay
- Areas where the subsoil in the Fern soil has more clay

Use and Management

Land use: Dominant use—cropland; other uses—woodland, pasture, building site development

Cropland

Major management concerns: Soil blowing on all three soils; water erosion, compaction, and tilth in areas of the Remus soil; seasonal droughtiness and a low content of organic matter in the Spinks and Fern soils

Management measures:
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer

are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation on all three soils, seedling mortality on the Fern soil

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness in the Spinks and Fern soils, overgrazing on all three soils, compaction in areas of the Remus soil

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks in areas of the Spinks and Fern soils

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Moderate permeability in the lower part of the subsoil in the Fern soil, moderately slow permeability in the Remus soil

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields in soils helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: Spinks—4A; Remus—3A; Fern—4S
Michigan soil management group: Spinks—4a; Remus—2.5a; Fern—4/2a

42C—Spinks-Remus-Fern complex, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 15 to 320 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Remus

Surface layer:
0 to 9 inches—dark grayish brown fine sandy loam

Subsoil:
9 to 21 inches—pale brown loamy sand and dark brown, friable loam
21 to 50 inches—dark reddish brown and brown, firm loam and sandy clay loam
50 to 60 inches—brown sandy clay loam

Fern

Surface layer:
0 to 10 inches—dark brown loamy fine sand

Subsoil:
10 to 21 inches—brown, very friable loamy fine sand
21 to 30 inches—pale brown loamy sand and dark brown, friable loam
30 to 51 inches—reddish brown, friable clay loam and pale brown loamy fine sand
51 to 60 inches—dark brown, friable loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Remus—moderately slow; Fern—rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Spinks and Fern—low; Remus—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Spinks and Fern—slow; Remus—medium
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 35 to 60 percent
Remus soil and similar soils: 20 to 50 percent
Fern soil and similar soils: 15 to 25 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona soils in depressions and on foot slopes

- The well drained Okee soils, which have sand and gravel at a depth of 20 to 40 inches and are in landscape positions similar to those of the Spinks, Remus, and Fern soils

Similar inclusions:

- Areas where the subsoil in the Spinks soil has less than 6 inches of loamy lamellae
- Areas where the subsoil in the Remus soil has more clay
- Areas where the subsoil in the Remus soil has less clay
- Areas where the subsoil in the Fern soil has more clay

Use and Management

Land use: Dominant use—cropland; other uses—woodland, pasture, building site development

Cropland

Major management concerns: Water erosion and soil blowing on all three soils, compaction and tilth in the surface layer in areas of the Remus soil, seasonal droughtiness and a low content of organic matter in the Spinks and Fern soils

Management measures:

- Crop rotations that include grasses and legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation on all three soils, seedling mortality on the Fern soil

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing in areas of all three soils, compaction in areas of the Remus soil

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

Buildings

Major management concerns: The instability of cutbanks in areas of the Spinks and Fern soils, the slope of all three soils

Management measures:

- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Moderate permeability in the lower part of the subsoil in the Fern soil, moderately slow permeability in the Remus soil

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: IIIe

Woodland ordination symbol: Spinks—4A; Remus—3A; Fern—4S

Michigan soil management group: Spinks—4a; Remus—2.5a; Fern—4/2a

42D—Spinks-Remus-Fern complex, 12 to 18 percent slopes

Setting

Landform: Hilly areas on ground moraines and end moraines

Shape of areas: Irregular

Size of areas: 15 to 80 acres

Typical Profile

Spinks

Surface layer:

0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Remus

Surface layer:
0 to 9 inches—dark grayish brown fine sandy loam

Subsoil:
9 to 21 inches—pale brown loamy sand and dark brown, friable loam
21 to 50 inches—dark reddish brown and brown, firm loam and sandy clay loam
50 to 60 inches—brown sandy clay loam

Fern

Surface layer:
0 to 10 inches—dark brown loamy fine sand

Subsoil:
10 to 21 inches—brown, very friable loamy fine sand
21 to 30 inches—pale brown loamy fine sand and dark brown, friable loam
30 to 51 inches—reddish brown, friable clay loam and pale brown loamy fine sand
51 to 60 inches—dark brown, friable loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Remus—moderately slow; Fern—rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Spinks and Fern—low; Remus—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Spinks and Fern—slow; Remus—rapid
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 35 to 60 percent
Remus soil and similar soils: 20 to 50 percent
Fern soil and similar soils: 15 to 25 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:

- The well drained Okee soils, which have sand and gravel at a depth of 20 to 40 inches and are in landscape positions similar to those of the Spinks, Remus, and Fern soils

Similar inclusions:

- Areas where the subsoil in the Spinks soil has less than 6 inches of loamy lamellae
- Areas where the subsoil in the Remus soil has more clay
- Areas where the subsoil in the Remus soil has less clay
- Areas where the subsoil in the Fern soil has more clay

Use and Management

Land use: Dominant use—cropland; other uses—woodland, pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, and the slope in areas of all three soils; compaction and tilth in areas of the Remus soil; a low content of organic matter and seasonal droughtiness in the Spinks and Fern soils

Management measures:

- Crop rotations that include grasses and legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: Equipment limitation on all three soils, seedling mortality on the Fern soil

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.

- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness and overgrazing in areas of all three soils, compaction in areas of the Remus soil

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.

Buildings

Major management concerns: The slope of all three soils, the instability of cutbanks in areas of the Spinks and Fern soils

Management measures:

- The sides of shallow excavations should be reinforced.
- Because of the slope, these soils are poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Moderate permeability in the lower part of the subsoil in the Fern soil, moderately slow permeability in the Remus soil, the slope of all three soils

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Spinks—4A; Remus—3A; Fern—4S
Michigan soil management group: Spinks—4a; Remus—2.5a; Fern—4/2a

42E—Spinks-Remus-Fern complex, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines
Shape of areas: Irregular or elongated
Size of areas: 10 to 60 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Remus

Surface layer:
0 to 9 inches—dark grayish brown fine sandy loam

Subsoil:
9 to 21 inches—pale brown loamy sand and dark brown, friable loam
21 to 50 inches—dark reddish brown and brown, firm loam and sandy clay loam
50 to 60 inches—brown sandy clay loam

Fern

Surface layer:
0 to 10 inches—dark brown loamy fine sand

Subsoil:
10 to 21 inches—brown, very friable loamy fine sand
21 to 30 inches—pale brown loamy sand and dark brown, friable loam
30 to 51 inches—reddish brown, friable clay loam and pale brown loamy fine sand
51 to 60 inches—dark brown, friable loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Remus—moderately slow; Fern—rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Spinks and Fern—low; Remus—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 35 to 60 percent
Remus soil and similar soils: 20 to 50 percent
Fern soil and similar soils: 15 to 25 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:

- The well drained Okee soils, which have sand and gravel at a depth of 20 to 40 inches

Similar inclusions:

- Areas where the subsoil in the Spinks soil has less than 6 inches of loamy lamellae
- Areas where the subsoil in the Remus soil has more clay
- Areas where the subsoil in the Remus soil has less clay
- Areas where the subsoil in the Fern soil has more clay

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard and equipment limitation on all three soils, seedling mortality on the Fern soil

Management measures:

- Because of the erosion hazard, logging roads and skid trails should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The slope of all three soils, the instability of cutbanks in areas of the Spinks and Fern soils

- Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: The slope of all three soils, moderate permeability in the lower part of the subsoil in the Fern soil, moderately slow permeability in the Remus soil

- Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe

Woodland ordination symbol: Spinks and Fern—4R; Remus—3R

Michigan soil management group: Spinks—4a; Remus—2.5a; Fern—4/2a

43B—Spinks loamy fine sand, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on outwash plains and ground moraines

Shape of areas: Irregular

Size of areas: 3 to 1,300 acres

Typical Profile

Surface layer:

0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:

9 to 18 inches—strong brown, very friable fine sand

18 to 24 inches—brown, loose fine sand

24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid

Available water capacity: Low

Drainage class: Well drained

Seasonal high water table: At a depth of more than 60 inches

Surface runoff: Very slow

Flooding: None

Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona and Thetford soils in drainageways and on foot slopes
- The excessively drained Benona and Coloma soils, which have less than 6 inches of lamellae in the subsoil and are in landscape positions similar to those of the Spinks soil
- The well drained Gowdy soils, which have a clayey subsoil at a depth of 20 to 40 inches and are in landscape positions similar to those of the Spinks soil
- The well drained Fern soils, which have a loamy subsoil at a depth of 20 to 40 inches and are in landscape positions similar to those of the Spinks soil

Similar inclusions:

- Areas where the subsoil has more than 15 percent gravel

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Drought-tolerant crops should be selected for planting. Otherwise, irrigation is needed.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: None

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: 4A
Michigan soil management group: 4a

43C—Spinks loamy fine sand, 6 to 12 percent slopes

Setting

Landform: Rolling areas on end moraines and ground moraines
Shape of areas: Irregular
Size of areas: 3 to 570 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand
Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The excessively drained Benona and Coloma soils, which have less than 6 inches of lamellae in the subsoil and are in landscape positions similar to those of the Spinks soil
- The well drained Fern soils, which have a loamy subsoil at a depth of 20 to 40 inches
- The well drained Gowdy soils, which have a clayey subsoil and substratum and are in landscape positions similar to those of the Spinks soil

Similar inclusions:

- Areas where the subsoil has more than 15 percent gravel
- Areas where the subsoil has mottles

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Crop rotations that include grasses, legumes, and small grain help to control runoff and water erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other

organic material help to conserve moisture.

- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: None

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4A
Michigan soil management group: 4a

43D—Spinks loamy fine sand, 12 to 18 percent slopes

Setting

Landform: Hilly areas on end moraines and ground moraines
Shape of areas: Irregular
Size of areas: 3 to 100 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The excessively drained Benona and Coloma soils, which have less than 6 inches of lamellae in the subsoil and are in landscape positions similar to those of the Spinks soil
- The well drained Fern soils, which have a loamy subsoil and substratum and are in landscape positions similar to those of the Spinks soil

Similar inclusions:

- Areas where the subsoil has 15 or more percent gravel

Use and Management

Land use: Dominant uses—woodland, cropland; other uses—pasture, building site development

Woodland

Major management concerns: None

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Crop rotations that include grasses, legumes, and small grain help to control runoff and water erosion.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping

sequence, no-till planting, and crop residue management increase the content of organic matter.

- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Slope

Management measures:

- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 4A
Michigan soil management group: 4a

43E—Spinks loamy fine sand, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines
Shape of areas: Irregular
Size of areas: 3 to 50 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The excessively drained Benona and Coloma soils, which have less than 6 inches of lamellae in the subsoil and are in landscape positions similar to those of the Spinks soil

Similar inclusions:

- Areas where the subsoil has more than 15 percent gravel

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.

Buildings

Major management concerns: Slope, the instability of cutbanks

Management measures:

- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Slope

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 4R
Michigan soil management group: 4a

44B—Thetford loamy fine sand, 0 to 4 percent slopes

Setting

Landform: Drainageways on ground moraines and outwash plains
Shape of areas: Irregular
Size of areas: 3 to 110 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 24 inches—brown, mottled, very friable loamy fine sand
24 to 54 inches—yellowish brown, mottled, loose sand that has lamellae of dark brown, very friable loamy sand

Substratum:
54 to 60 inches—brown, mottled sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: 1 to 2 feet below the surface from February through May
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Thetford soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The poorly drained Granby soils in depressions
- The excessively drained Chelsea and well drained Spinks soils in the higher landscape positions
- The somewhat poorly drained Pipestone soils, which are sandy throughout and are in landscape positions similar to those of the Thetford soil

Similar inclusions:

- Areas where the subsoil has more gravel
- Areas where the substratum is stratified

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Seasonal wetness, soil blowing, seasonal droughtiness

Management measures:

- Surface and subsurface drainage systems are needed to reduce the wetness.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Increasing the content of organic matter in the root zone can improve the ability of the soil to hold water, nutrients, and pesticides and reduces the risk of ground-water pollution.

Woodland

Major management concerns: Equipment limitation

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Trees that can withstand seasonal wetness should be selected for planting.

Pasture

Major management concerns: Seasonal wetness, seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, a planned grazing system, controlled grazing, restricted use during dry periods, and deferred grazing during wet periods help to keep the pasture in good condition.

Buildings

Major management concerns: Seasonal wetness, the instability of cutbanks

Management measures:

- A surface or subsurface drainage system helps to lower the water table.
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness

Management measures:

- A subsurface drainage system helps to lower the water table.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 3W
Michigan soil management group: 4b

45B—Spinks-Benona complex, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines and outwash plains
Shape of areas: Irregular
Size of areas: 10 to 725 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Benona

Surface layer:
0 to 8 inches—dark brown sand

Subsoil:
8 to 46 inches—dark brown, strong brown, and dark yellowish brown, loose sand
46 to 60 inches—pale brown, loose sand that has lamellae of strong brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Benona—rapid
Available water capacity: Low
Drainage class: Spinks—well drained; Benona—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Spinks—moderate; Benona—severe

Composition

Spinks soil and similar soils: 40 to 55 percent
Benona soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona and Pipestone soils in drainageways and swales on foot slopes
- The well drained Fern soils, which have a loamy subsoil and substratum and are in landscape positions similar to those of the Spinks and Benona soils
- The well drained Gowdy soils, which are clayey in the lower part of the subsoil and in the substratum and are in landscape positions similar to those of the Spinks and Benona soils

Similar inclusions:

- Areas where the subsoil is sandy throughout
- Areas where the Benona soil has a calcareous substratum at a depth of more than 60 inches
- Areas where the Benona soil has a loamy and clayey, banded substratum at a depth of more than 60 inches

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Because of the limited available water capacity, most crops should be irrigated.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation on both soils, seedling mortality on the Benona soil

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability in the Benona soil, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: Spinks—4A; Benona—4S
Michigan soil management group: Spinks—4a; Benona—5a

45C—Spinks-Benona complex, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 420 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand
Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Benona

Surface layer:
0 to 8 inches—dark brown sand
Subsoil:
8 to 46 inches—dark brown, strong brown, and dark yellowish brown, loose sand
46 to 60 inches—pale brown, loose sand that has lamellae of strong brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Benona—rapid
Available water capacity: Low
Drainage class: Spinks—well drained; Benona—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Spinks—moderate; Benona—severe

Composition

Spinks soil and similar soils: 40 to 60 percent
Benona soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Fern soils, which have a loamy subsoil and substratum and are in landscape positions similar to those of the Spinks and Benona soils
- The well drained Gowdy soils, which are clayey in the lower part of the subsoil and in the substratum and are in landscape positions similar to those of the Spinks and Benona soils

Similar inclusions:

- Areas where the subsoil is sandy throughout
- Areas where the Benona soil has a calcareous substratum at a depth of more than 60 inches
- Areas where the Benona soil has a loamy and clayey, banded substratum at a depth of more than 60 inches

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Crop rotations that include grasses and legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
- Applying a system of conservation tillage, establishing

windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Because of the limited available water capacity, most crops should be irrigated.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation on both soils, seedling mortality on the Benona soil

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:
- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability in the Benona soil, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Spinks—4A; Benona—4S
Michigan soil management group: Spinks—4a; Benona—5a

45D—Spinks-Benona complex, 12 to 18 percent slopes

Setting

Landform: Hilly areas on ground moraines
Shape of areas: Irregular
Size of areas: 20 to 120 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Benona

Surface layer:
0 to 8 inches—dark brown sand

Subsoil:
8 to 46 inches—dark brown, strong brown, and dark yellowish brown, loose sand
46 to 60 inches—pale brown, loose sand that has lamellae of strong brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Benona—rapid
Available water capacity: Low
Drainage class: Spinks—well drained; Benona—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Spinks—moderate; Benona—severe

Composition

Spinks soil and similar soils: 40 to 60 percent
Benona soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Fern soils, which have a loamy subsoil and substratum and are in landscape positions similar to those of the Spinks and Benona soils
- The well drained Gowdy soils, which are clayey in the lower part of the subsoil and in the substratum and are

in landscape positions similar to those of the Spinks and Benona soils

Similar inclusions:

- Areas where the subsoil is sandy throughout
- Areas where the Benona soil has a calcareous substratum at a depth of more than 60 inches
- Areas where the Benona soil has a loamy and clayey, banded substratum at a depth of more than 60 inches

Use and Management

Land use: Dominant uses—woodland, cropland; other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation on both soils, seedling mortality on the Benona soil

Management measures:

- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Cropland

Major management concerns: Water erosion, soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Crop rotations that include grasses and legumes, conservation tillage, grassed waterways, and cover crops help to control water erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Because of the limited available water capacity, most crops should be irrigated.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Because of the slope, these soils are poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Rapid permeability in the Benona soil, which causes poor filtering and a hazard of ground-water pollution; the slope of both soils

Management measures:

- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 4A
Michigan soil management group: Spinks—4a; Benona—5a

45E—Spinks-Benona complex, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Benona

Surface layer:
0 to 8 inches—dark brown sand

Subsoil:
8 to 46 inches—dark brown, strong brown, and dark yellowish brown, loose sand
46 to 60 inches—pale brown, loose sand that has lamellae of strong brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Benona—rapid
Available water capacity: Low
Drainage class: Spinks—well drained; Benona—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Spinks—moderate; Benona—severe

Composition

Spinks soil and similar soils: 40 to 60 percent
Benona soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Fern soils, which have a loamy subsoil and substratum and are in landscape positions similar to those of the Spinks and Benona soils
- The well drained Gowdy soils, which are clayey in the lower part of the subsoil and in the substratum and are in landscape positions similar to those of the Spinks and Benona soils

Similar inclusions:

- Areas where the subsoil is sandy throughout
- Areas where the Benona soil has a calcareous substratum at a depth of more than 60 inches
- Areas where the Benona soil has a loamy and clayey, banded substratum at a depth of more than 60 inches

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard and equipment limitation on both soils, seedling mortality on the Benona soil

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand and the slope can hinder the traction of wheeled equipment, logging roads should be built on the contour or on the gentler slopes.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Slope, the instability of cutbanks

Management measures:

- Because of the slope, these soils are poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: The slope of both soils; rapid permeability in the Benona soil, which causes poor filtering and a hazard of ground-water pollution

- Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 4R
Michigan soil management group: Spinks—4a; Benona—5a

45F—Spinks-Benona complex, 35 to 70 percent slopes

Setting

Landform: Very steep areas on end moraines
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Benona

Surface layer:
0 to 8 inches—dark brown sand

Subsoil:
8 to 46 inches—dark brown, strong brown, and dark yellowish brown, loose sand
46 to 60 inches—pale brown, loose sand that has lamellae of strong brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Benona—rapid
Available water capacity: Low
Drainage class: Spinks—well drained; Benona—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Spinks—moderate; Benona—severe

Composition

Spinks soil and similar soils: 40 to 60 percent
Benona soil and similar soils: 35 to 60 percent

Inclusions

Similar inclusions:

- Areas where the subsoil is sandy throughout
- Areas where the Benona soil has a calcareous substratum at a depth of more than 60 inches

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard and equipment limitation on both soils, seedling mortality on the Benona soil

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Slope, the instability of cutbanks

- Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: The slope of both soils; rapid permeability in the Benona soil, which causes poor filtering and a hazard of ground-water pollution

- Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 4R
Michigan soil management group: Spinks—4a; Benona—5a

46B—Grattan sand, dark subsoil, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on lake plains
Shape of areas: Irregular
Size of areas: 50 to 450 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 8 inches—grayish brown sand

Subsoil:
8 to 10 inches—dark reddish brown, loose sand
10 to 32 inches—dark brown and strong brown, loose sand

Substratum:
32 to 60 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Grattan soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Pipestone soils in drainageways and on foot slopes

Similar inclusions:

- Areas where the surface layer is severely eroded
- Areas where the subsoil is fine sand

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 3S
Michigan soil management group: 5a

48A—Saugatuck-Jebavy complex, 0 to 3 percent slopes

Setting

Landform: Saugatuck—drainageways on lake plains and outwash plains; Jebavy—depressions on outwash plains and lake plains
Shape of areas: Irregular
Size of areas: 30 to 825 acres

Typical Profile

Saugatuck

Surface layer:
0 to 3 inches—black fine sand

Subsurface layer:
3 to 7 inches—grayish brown, mottled fine sand

Subsoil:
7 to 21 inches—dark reddish brown, mottled, weakly cemented, loose fine sand
21 to 38 inches—dark brown and dark yellowish brown, mottled, loose fine sand

Substratum:
38 to 60 inches—yellowish brown fine sand

Jebavy

Surface layer:
0 to 4 inches—black fine sand

Subsurface layer:
4 to 12 inches—dark gray, mottled fine sand

Subsoil:
12 to 16 inches—black, mottled, weakly cemented, loose fine sand
16 to 36 inches—yellowish brown, mottled, loose fine sand

Substratum
36 to 80 inches—pale brown, mottled sand

Soil Properties and Qualities

Permeability: Rapid in the upper and lower parts of the profile and moderate in the middle part
Available water capacity: Low
Drainage class: Saugatuck—somewhat poorly drained; Jebavy—poorly drained
Seasonal high water table: Saugatuck—perched 0.5 foot above to 2.0 feet below the surface from November through May; Jebavy—perched 1.0 foot above to 1.0 foot below the surface from October through June
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: Severe

Composition

Saugatuck soil and similar soils: 40 to 60 percent
Jebavy soil and similar soils: 35 to 50 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The very poorly drained Adrian soils, which have 16 to 51 inches of muck and are in landscape positions similar to those of the Jebavy soil
- The moderately well drained Covert soils in the slightly higher landscape positions
- The excessively drained Epworth soils on knolls
- The poorly drained Granby and Kingsville soils, which do not have a weakly cemented subsoil and are in landscape positions similar to those of the Jebavy soil

Similar inclusions:
- Areas where the subsoil in the Saugatuck soil is not cemented
- Areas where the subsoil is medium sand

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soils are dry, or midwinter, when the soils are frozen.
- Special site preparation, such as bedding before planting, can reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness, seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: Ponding, the instability of cutbanks
- Because of the ponding, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding; rapid permeability, which causes poor filtering and a hazard of ground-water pollution
- Because of the ponding, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: IVw
Woodland ordination symbol: 2W
Michigan soil management group: Saugatuck—5b-h; Jebavy—5c-h

49B—Grattan sand, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on outwash plains
Shape of areas: Irregular
Size of areas: 3 to 980 acres

Typical Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsurface layer:
3 to 6 inches—grayish brown sand

Subsoil:
6 to 32 inches—dark brown and dark yellowish brown, loose sand

Substratum:
32 to 60 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Grattan soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Covert soils in the slightly lower landscape positions
- The poorly drained Kingsville soils in depressions
- The somewhat poorly drained Pipestone soils in drainageways and on foot slopes
- The well drained Spinks soils, which have more than 6 inches of loamy lamellae in the subsoil and are in landscape positions similar to those of the Grattan soil

Similar inclusions:
- Areas where the soil has loamy material at a depth of more than 40 inches
- Areas where the soil has a banded substratum at a depth of more than 60 inches

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 9S
Michigan soil management group: 5.3a

49B3—Grattan sand, 0 to 6 percent slopes, severely eroded

Setting

Landform: Nearly level and undulating areas on outwash plains
Shape of areas: Irregular
Size of areas: 3 to 120 acres

Typical Profile

Subsoil:
0 to 22 inches—dark brown and brownish yellow, loose sand

Substratum:
22 to 60 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Grattan soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:

- The poorly drained Kingsville soils and Histosols and Aquents, ponded, in depressions

Similar inclusions:

- Areas where the soil has a surface layer
- Areas where the subsoil is fine sand

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 9S
Michigan soil management group: 5.3a

49C—Grattan sand, 6 to 18 percent slopes

Setting

Landform: Rolling and hilly areas on ground moraines and outwash plains
Shape of areas: Irregular
Size of areas: 3 to 120 acres

Typical Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsurface layer:
3 to 6 inches—grayish brown sand

Subsoil:
6 to 32 inches—dark brown and dark yellowish brown, loose sand

Substratum:
32 to 60 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Grattan soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Pipestone soils in drainageways and on foot slopes
- The well drained Spinks soils, which have more than 6 inches of loamy lamellae in the subsoil and are in landscape positions similar to those of the Grattan soil

Similar inclusions:
- Areas where the soil has loamy material at a depth of more than 40 inches
- Areas where the soil is fine sand throughout
- Areas where the soil has a banded substratum at a depth of more than 60 inches

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:
- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 9S
Michigan soil management group: 5.3a

49C3—Grattan sand, 6 to 18 percent slopes, severely eroded

Setting

Landform: Rolling and hilly areas on ground moraines and outwash plains
Shape of areas: Irregular
Size of areas: 3 to 60 acres

Typical Profile

Subsoil:
0 to 22 inches—dark brown and brownish yellow, loose sand

Substratum:
22 to 60 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Grattan and similar soils: 100 percent

Inclusions

Similar inclusions:
- Areas where the soil has a surface layer
- Areas where the soil is fine sand throughout

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 9S
Michigan soil management group: 5.3a

49E—Grattan sand, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines
Shape of areas: Irregular
Size of areas: 3 to 100 acres

Typical Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsurface layer:
3 to 6 inches—grayish brown sand

Subsoil:
6 to 32 inches—dark brown and dark yellowish brown, loose sand

Substratum:
32 to 60 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Grattan soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The well drained Spinks soils, which have more than 6 inches of loamy lamellae in the subsoil and are in landscape positions similar to those of the Grattan soil

Similar inclusions:

- Areas where the soil is fine sand throughout

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, seedling mortality

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid trails should be built on the contour or on the gentler slopes.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Slope, the instability of cutbanks

- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope; rapid permeability, which causes poor filtering and a hazard of groundwater pollution

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 9R
Michigan soil management group: 5.3a

49F—Grattan sand, 35 to 70 percent slopes

Setting

Landform: Very steep areas on end moraines
Shape of areas: Irregular or elongated
Size of areas: 10 to 35 acres

Typical Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsurface layer:
3 to 6 inches—grayish brown sand

Subsoil:
6 to 32 inches—dark brown and dark yellowish brown, loose sand

Substratum:
32 to 60 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Severe

Composition

Grattan soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:

- The well drained Spinks soils, which have more than 6 inches of loamy lamellae in the subsoil and are in landscape positions similar to those of the Grattan soil

Similar inclusions:

- Areas where the soil is sandy throughout

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, seedling mortality

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Ordinary crawler tractors and rubber-tire skidders cannot be operated safely on these slopes. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Slope, the instability of cutbanks

- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope; rapid permeability, which causes poor filtering and a hazard of groundwater pollution

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 9R
Michigan soil management group: 5.3a

50B—Covert sand, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on outwash plains and lake plains
Shape of areas: Irregular
Size of areas: 3 to 120 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsurface layer:
1 to 4 inches—grayish brown sand

Subsoil:
4 to 29 inches—dark brown and strong brown, loose sand
29 to 33 inches—brownish yellow, mottled, loose sand

Substratum:
33 to 52 inches—pale brown, mottled sand
33 to 60 inches—brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: 2.0 to 3.5 feet below the surface from November through April
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Covert soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The excessively drained Epworth, Grattan, and Plainfield soils in the slightly higher landscape positions
- The poorly drained Granby and Kingsville soils in depressions
- The somewhat poorly drained Pipestone soils in depressions and on foot slopes

Similar inclusions:
- Areas where the substratum is loamy at a depth of more than 40 inches
- Areas where the soil is fine sand throughout

Use and Management

Land use: Dominant uses—woodland, cropland; other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Because of the limited available water capacity, most crops should be irrigated.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, seasonal wetness

Management measures:
- The sides of shallow excavations should be reinforced.
- Wetness in structures with basements and crawl spaces can be reduced by a drainage system.

Septic tank absorption fields

Major management concerns: Seasonal wetness; rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Management measures:
- Mounding or adding suitable fill material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 4S
Michigan soil management group: 5a

51B—Pipestone fine sand, 0 to 4 percent slopes

Setting

Landform: Nearly level and undulating areas on lake plains and outwash plains
Shape of areas: Irregular
Size of areas: 3 to 200 acres

Typical Profile

Surface layer:
0 to 2 inches—black fine sand

Subsurface layer:
2 to 12 inches—light brownish gray fine sand

Subsoil:
12 to 18 inches—dark reddish brown, mottled, loose fine sand
18 to 38 inches—strong brown, mottled, loose sand

Substratum:
38 to 60 inches—yellowish brown, mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: 0.5 foot to 1.5 feet below the surface from October through June
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Pipestone soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Epworth, Grattan, and Plainfield soils in the higher landscape positions
- The poorly drained Granby and Kingsville soils in depressions

Similar inclusions:
- Areas where the subsoil is cemented
- Areas where the substratum is loamy at a depth of more than 40 inches

Use and Management

Land use: Dominant uses—woodland, pasture; other uses—cropland, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Special site preparation, such as bedding before planting, can reduce the seedling mortality rate.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness, seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Cropland

Major management concerns: Seasonal wetness, soil blowing, seasonal droughtiness

Management measures:
- Surface and subsurface drainage systems are needed to reduce the wetness.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Buildings

Major management concerns: Seasonal wetness, the instability of cutbanks

Management measures:
- A surface or subsurface drainage system helps to lower the water table.

- Buildings can be constructed on well compacted fill material that raises the site a sufficient distance above the water table.
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Seasonal wetness; rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Management measures:

- A subsurface drainage system helps to lower the water table.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: IVw
Woodland ordination symbol: 3W
Michigan soil management group: 5b

52—Granby sand

Setting

Landform: Depressions on outwash plains and lake plains
Shape of areas: Irregular or elongated
Size of areas: 3 to 700 acres

Typical Profile

Surface layer:
0 to 11 inches—black sand

Subsoil:
11 to 28 inches—light brownish gray, loose sand

Substratum:
28 to 60 inches—grayish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from November through June
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: Severe

Composition

Granby soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat excessively drained Benona soils on knolls
- The somewhat poorly drained Pipestone and Saugatuck soils in the slightly higher landscape positions
- The very poorly drained, organic Adrian, Houghton, and Palms soils in landscape positions similar to those of the Granby soil

Similar inclusions:

- Areas where the substratum is gravelly below at a depth of 40 inches
- Areas where the surface layer is less than 10 inches thick

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Seasonal wetness, soil blowing, seasonal droughtiness

Management measures:

- Surface and subsurface drainage systems are needed to reduce the wetness, but a subsurface system requires a suitable outlet.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness, seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: Ponding, the instability of cutbanks

- Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding; rapid permeability, which causes poor filtering and a hazard of ground-water pollution

- Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: IVw
Woodland ordination symbol: 2W
Michigan soil management group: 5c

53B—Grattan sand, loamy substratum, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 80 acres

Typical Profile

Surface layer:
0 to 9 inches—gray sand

Subsurface layer:
9 to 14 inches—light gray sand

Subsoil:
14 to 36 inches—dark brown and strong brown, loose sand

Substratum:
36 to 48 inches—yellowish brown sand
48 to 60 inches—dark reddish brown clay loam

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and moderately slow or slow in the lower part
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Grattan soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The moderately well drained Covert soils in the slightly lower landscape positions
- The poorly drained Kingsville soils in depressions
- The somewhat poorly drained Pipestone soils in drainageways and on foot slopes

Similar inclusions:

- Areas where the soil has sandy lamellae in the subsoil
- Areas where the soil is sandy throughout
- Areas where the soil has a banded substratum

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability in the subsoil, which causes poor filtering and a hazard of ground-water pollution; moderately slow permeability in the substratum

Management measures:

- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: VIs

Woodland ordination symbol: 9S
Michigan soil management group: 5/2a

53C—Grattan sand, loamy substratum, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 50 acres

Typical Profile

Surface layer:
0 to 9 inches—gray sand

Subsurface layer:
9 to 14 inches—light gray sand

Subsoil:
14 to 36 inches—dark brown and strong brown, loose sand

Substratum:
36 to 48 inches—yellowish brown sand
48 to 60 inches—dark reddish brown clay loam

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and moderately slow or slow in the lower part
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Grattan soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Covert soils in the slightly lower landscape positions
- The somewhat poorly drained Pipestone soils in drainageways and on foot slopes

Similar inclusions:
- Areas where the soil has sandy lamellae in the subsoil

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:
- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability in the subsoil, which causes poor filtering and a hazard of ground-water pollution; moderately slow permeability in the substratum

Management measures:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 9S
Michigan soil management group: 5/2a

56B—Benona sand, deep banded, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on lake plains
Shape of areas: Irregular
Size of areas: 15 to 100 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray sand

Subsoil:
8 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand
48 to 87 inches—brownish yellow, loose sand that has lamellae of strong brown, loose sand
87 to 91 inches—strong brown, firm clay loam
91 to 99 inches—pale brown, loose sand

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Benona soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Pipestone soils in drainageways and on foot slopes

Similar inclusions:
- Areas where the soil has more than 6 inches of loamy lamellae
- Areas where the soil is sandy throughout
- Areas where the substratum has loamy material at a depth of 40 to 60 inches

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Because of the limited available water capacity, most crops should be irrigated.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 3S
Michigan soil management group: 5a

56C—Benona sand, deep banded, 6 to 18 percent slopes

Setting

Landform: Rolling and hilly areas on ground moraines
Shape of areas: Irregular
Size of areas: 3 to 95 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray sand

Subsoil:
8 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand
48 to 87 inches—brownish yellow, loose sand that has lamellae of strong brown, loose sand
87 to 91 inches—strong brown, firm clay loam
91 to 99 inches—pale brown, loose sand

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Benona soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Pipestone soils in drainageways and on foot slopes

Similar inclusions:
- Areas where the soil has more than 6 inches of loamy lamellae
- Areas where the soil is sandy throughout
- Areas where the substratum has loamy material at a depth of 40 to 60 inches

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:
- The sides of shallow excavations should be reinforced.
- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 3S
Michigan soil management group: 5a

56E—Benona sand, deep banded, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines
Shape of areas: Irregular
Size of areas: 30 to 100 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray sand

Subsoil:
8 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand
48 to 87 inches—brownish yellow, loose sand that has lamellae of strong brown, loose sand
87 to 91 inches—strong brown, firm clay loam
91 to 97 inches—pale brown, loose sand

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and moderate in the lower part
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Severe

Composition

Benona soil and similar soils: 100 percent

Inclusions

Similar inclusions:

- Areas where the soil is sandy throughout
- Areas where the substratum has loamy material at a depth of 40 to 60 inches

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, seedling mortality

Management measures:

- Because of the erosion hazard, logging roads and skid trails should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid trails should be built on the contour or on the gentler slopes.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Slope, the instability of cutbanks

- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope; rapid permeability, which causes poor filtering and a hazard of ground-water pollution

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 3R
Michigan soil management group: 5a

57C—Nordhouse fine sand, 3 to 18 percent slopes

Setting

Landform: Nearly level to hilly areas on dunes
Shape of areas: Irregular
Size of areas: 35 to 300 acres

Typical Profile

Surface layer:
0 to 1 inch—black fine sand

Subsurface layer:
1 to 8 inches—light brownish gray fine sand

Subsoil:
8 to 34 inches—strong brown and brownish yellow, loose fine sand

Substratum:
34 to 60 inches—very pale brown fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Nordhouse soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The very poorly drained Histosols and Aquents, ponded, in depressions

Similar inclusions:

- Areas where the subsoil is sand
- Areas where the surface layer is severely eroded

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.
- This soil is in a sensitive area on stabilizing dunes where management measures are severely restricted.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.

• Because of the slope, this soil is poorly suited to building site development without extensive land shaping. It is in a sensitive area where management measures are severely restricted.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

• This soil is in a sensitive area where management measures are severely restricted.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.7a

57F—Nordhouse fine sand, 18 to 75 percent slopes

Setting

Landform: Steep and very steep areas on dunes
Shape of areas: Irregular or elongated
Size of areas: 15 to 460 acres

Typical Profile

Surface layer:
0 to 1 inch—black fine sand

Subsurface layer:
1 to 8 inches—light brownish gray fine sand

Subsoil:
8 to 34 inches—strong brown and brownish yellow, loose fine sand

Substratum:
34 to 60 inches—very pale brown fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Severe

Composition

Nordhouse soil and similar soils: 100 percent

Inclusions

Similar inclusions:
• Areas where the surface layer is severely eroded

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Water erosion, equipment limitation, seedling mortality

Management measures:

• Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.

• Ordinary crawler tractors and rubber-tire skidders cannot be operated safely on these slopes. As a result, special logging methods, such as yarding the logs with a cable, may be needed.

• Because loose sand and the slope can hinder the traction of wheeled equipment, skid trails should be built on the contour or on the gentler slopes.

• Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

• This soil is in a sensitive area on stabilizing dunes where management measures are severely restricted.

Buildings

Major management concerns: Slope, the instability of cutbanks

• Because of the slope, this soil is generally unsuited to building site development. It is in a sensitive area where management measures are severely restricted.

Septic tank absorption fields

Major management concerns: Slope; rapid permeability, which causes poor filtering and a hazard of ground-water pollution

• Because of the slope, this soil is generally unsuited to septic tank absorption fields. It is in a sensitive area where management measures are severely restricted.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.7a

58—Kingsville mucky sand

Setting

Landform: Depressions on lake plains and outwash plains
Slope: 0 to 2 percent

Shape of areas: Irregular or elongated
Size of areas: 3 to 360 acres

Typical Profile

Surface layer:
0 to 7 inches—black mucky sand

Subsoil:
7 to 24 inches—light brownish gray, loose sand

Substratum:
24 to 60 inches—light gray sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from January through April
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: Severe

Composition

Kingsville soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The excessively drained Grattan and Plainfield soils in the higher landscape positions
- The organic Adrian, Houghton, and Palms soils in landscape positions similar to those of the Kingsville soil
- Lamson soils, which have a loamy subsoil and are in landscape positions similar to those of the Kingsville soil
- The somewhat poorly drained Pipestone soils in the slightly higher landscape positions

Similar inclusions:

- Areas where the substratum has 10 or more percent gravel
- Areas where the surface layer is more than 10 inches thick
- Areas where the soil has a mucky surface layer

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness, seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: Ponding, the instability of cutbanks

- Because of the ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Ponding; rapid permeability, which causes poor filtering and a hazard of ground-water pollution

- Because of the ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 5W
Michigan soil management group: 5c

59B—Benona sand, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on outwash plains, ground moraines, and lake plains
Shape of areas: Irregular
Size of areas: 3 to 350 acres

Typical Profile

Surface layer:
0 to 8 inches—dark brown sand

Subsoil:
8 to 46 inches—dark brown, strong brown, and dark yellowish brown, loose sand

46 to 60 inches—pale brown, loose sand that has lamellae of strong brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Benona soil and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The moderately well drained Covert soils in the slightly lower landscape positions
- The poorly drained Granby soils in depressions
- The somewhat poorly drained Pipestone soils in drainageways and on foot slopes
- The well drained Spinks soils, which have more than 6 inches of lamellae and are in landscape positions similar to those of the Benona soil

Similar inclusions:

- Areas where the soil is sandy throughout
- Areas where the soil has a loamy substratum at a depth of more than 40 inches
- Areas where the soil has a banded substratum at a depth of more than 60 inches

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Because of the limited available water capacity, most crops should be irrigated.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 4S
Michigan soil management group: 5a

59C—Benona sand, 6 to 18 percent slopes

Setting

Landform: Rolling and hilly areas on end moraines, ground moraines, and outwash plains
Shape of areas: Irregular
Size of areas: 3 to 95 acres

Typical Profile

Surface layer:
0 to 8 inches—dark brown sand

Subsoil:
8 to 46 inches—dark brown, strong brown, and dark yellowish brown, loose sand

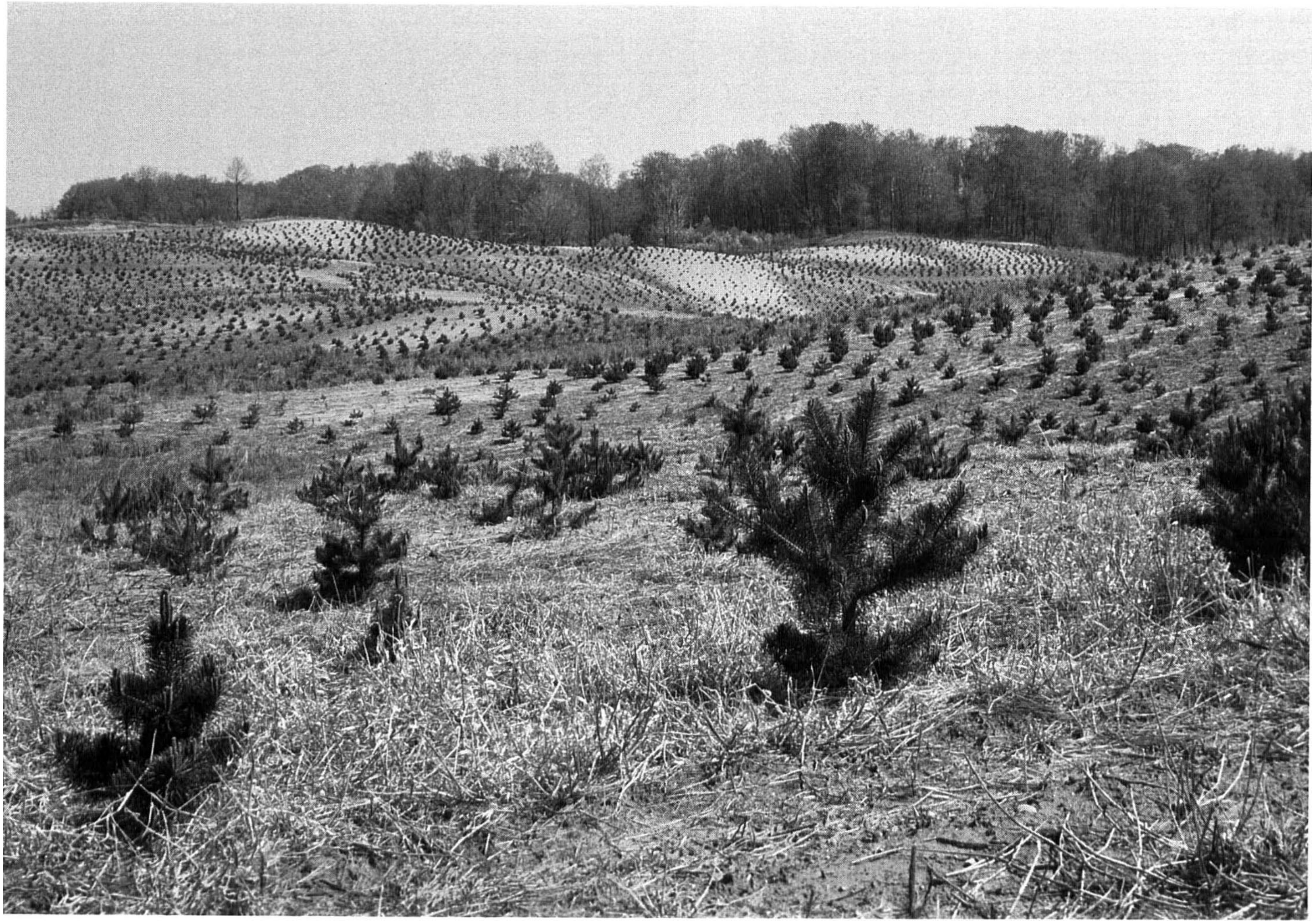

Figure 5.—A Christmas tree plantation in an area of Benona sand, 6 to 18 percent slopes.

46 to 60 inches—pale brown, loose sand that has lamellae of strong brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Benona soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The well drained Spinks soils, which have more than 6 inches of lamellae and are in landscape positions similar to those of the Benona soil

Similar inclusions:

- Areas where the soil is sandy throughout
- Areas where the soil has a loamy substratum at a depth of more than 40 inches
- Areas where the soil has a deep banded substratum at a depth of more than 60 inches

Use and Management

Land use: Dominant use—woodland (fig. 5); other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5a

59E—Benona sand, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines
Shape of areas: Irregular or elongated
Size of areas: 3 to 65 acres

Typical Profile

Surface layer:
0 to 8 inches—dark brown sand

Subsoil:
8 to 46 inches—dark brown, strong brown, and dark yellowish brown, loose sand
46 to 60 inches—pale brown, loose sand that has lamellae of strong brown, very friable loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Severe

Composition

Benona soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:

- The well drained Spinks soils, which have more than 6 inches of lamellae and are in landscape positions similar to those of the Benona soil

Similar inclusions:

- Areas where the soil is sandy throughout
- Areas where the soil has a deep banded substratum at a depth of more than 60 inches

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, seedling mortality

Management measures:

- Because of the erosion hazard, logging roads and skid trails should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid trails should be built on the contour or on the gentler slopes.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Slope, the instability of cutbanks

- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope; rapid permeability, which causes poor filtering and a hazard of ground-water pollution

- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5a

60B—Coloma sand, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on outwash plains and ground moraines
Shape of areas: Irregular
Size of areas: 3 to 350 acres

Typical Profile

Surface layer:
0 to 4 inches—very dark grayish brown sand
Subsoil:
4 to 35 inches—yellowish brown and brownish yellow, loose sand
35 to 80 inches—light yellowish brown, loose sand that has lamellae of dark brown, loose loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Coloma soil and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Altmar soils in drainageways and on foot slopes
- The well drained Okee and Toogood soils, which have sand and gravel at a depth of 20 to 40 inches and are in landscape positions similar to those of the Coloma soil

Similar inclusions:

- Areas where the soil has more than 6 inches of loamy lamellae
- Areas where the soil is sandy throughout
- Areas where the soil has loamy material at a depth of more than 40 inches
- Areas where the upper part of the subsoil is darker

Use and Management

Land use: Dominant uses—woodland, cropland; other uses—pasture, building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Because of the limited available water capacity, most crops should be irrigated.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 2S
Michigan soil management group: 5a

60C—Coloma sand, 6 to 18 percent slopes

Setting

Landform: Rolling and hilly areas on end moraines, outwash plains, and ground moraines
Shape of areas: Irregular
Size of areas: 3 to 150 acres

Typical Profile

Surface layer:
0 to 4 inches—very dark grayish brown sand

Subsoil:
4 to 35 inches—yellowish brown and brownish yellow, loose sand
35 to 80 inches—light yellowish brown, loose sand that has lamellae of dark brown, loose loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Coloma soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The well drained Okee and Toogood soils, which have sand and gravel at a depth of 20 to 40 inches and are in landscape positions similar to those of the Coloma soil

Similar inclusions:

- Areas where the soil has more than 6 inches of loamy lamellae
- Areas where the soil is sandy throughout
- Areas where the soil has loamy material at a depth of more than 40 inches

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 2S
Michigan soil management group: 5a

60E—Coloma sand, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines
Shape of areas: Irregular
Size of areas: 3 to 150 acres

Typical Profile

Surface layer:
0 to 4 inches—very dark grayish brown sand

Subsoil:
4 to 35 inches—yellowish brown and brownish yellow, loose sand
35 to 80 inches—light yellowish brown, loose sand that has lamellae of dark brown, loose loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Coloma soil and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The well drained Okee soils, which have sand and gravel at a depth of 20 to 40 inches and are in landscape positions similar to those of the Coloma soil

Similar inclusions:
- Areas where the soil has more than 6 inches of loamy lamellae
- Areas where the soil is sandy throughout
- Areas where the soil has loamy material at a depth of more than 40 inches
- Areas where the upper part of the subsoil is darker

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, seedling mortality

Management measures:
- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Slope, the instability of cutbanks
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope; rapid permeability, which causes poor filtering and a hazard of ground-water pollution
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 2R
Michigan soil management group: 5a

61B—Epworth fine sand, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on lake plains
Shape of areas: Irregular
Size of areas: 15 to 425 acres

Typical Profile

Surface layer:
0 to 1 inch—black fine sand

Subsurface layer:
1 to 3 inches—grayish brown fine sand

Subsoil:
3 to 24 inches—dark brown and strong brown, loose fine sand

Substratum:
24 to 60 inches—yellowish brown and brownish yellow fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Epworth soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Covert soils in the slightly lower landscape positions
- The somewhat poorly drained Pipestone soils in drainageways and on foot slopes

Similar inclusions:
- Areas where the subsoil is sand
- Areas where the upper part of the subsoil is lighter colored

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The instability of cutbanks

Management measures:
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a

61C—Epworth fine sand, 6 to 18 percent slopes

Setting

Landform: Rolling and hilly areas on lake plains and beach ridges
Shape of areas: Irregular
Size of areas: 45 to 670 acres

Typical Profile

Surface layer:
0 to 1 inch—black fine sand

Subsurface layer:
1 to 3 inches—grayish brown fine sand

Subsoil:
3 to 24 inches—dark brown and strong brown, loose fine sand

Substratum:
24 to 60 inches—yellowish brown and brownish yellow fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Epworth soil and similar soils: 100 percent

Inclusions

Similar inclusions:
- Areas where the upper part of the subsoil is lighter colored

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:
- The sides of shallow excavations should be reinforced.
- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a

61E—Epworth fine sand, 18 to 35 percent slopes

Setting

Landform: Steep areas on lake plains and beach ridges
Shape of areas: Irregular or elongated
Size of areas: 10 to 40 acres

Typical Profile

Surface layer:
0 to 1 inch—black fine sand

Subsurface layer:
1 to 3 inches—grayish brown fine sand

Subsoil:
3 to 24 inches—dark brown and strong brown, loose fine sand

Substratum:
24 to 60 inches—yellowish brown and brownish yellow fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Epworth soil and similar soils: 100 percent

Inclusions

Similar inclusions:
- Areas where the upper part of the subsoil is lighter colored

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation, seedling mortality

Management measures:
- Because of the erosion hazard, logging roads and skid trails should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Slope, the instability of cutbanks
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope; rapid permeability, which causes poor filtering and a hazard of ground-water pollution
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: 4R
Michigan soil management group: 5.3a

62B—Plainfield sand, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on outwash plains
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 30 inches—dark brown and strong brown, loose sand

Substratum:
30 to 60 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained

Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Plainfield soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Covert soils in the slightly lower landscape positions
- The poorly drained Kingsville soils in depressions
- The somewhat poorly drained Pipestone soils in drainageways and on foot slopes

Similar inclusions:
- Areas where the soil is fine sand throughout
- Areas where the soil has loamy and sandy lamellae
- Areas where the upper part of the subsoil is darker

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The instability of cutbanks

Management measures:
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 8S
Michigan soil management group: 5.3a

62C—Plainfield sand, 6 to 18 percent slopes

Setting

Landform: Rolling and hilly areas on outwash plains
Shape of areas: Irregular
Size of areas: 15 to 55 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 30 inches—dark brown and strong brown, loose sand

Substratum:
30 to 60 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Plainfield soil and similar soils: 100 percent

Inclusions

Similar inclusions:
- Areas where the soil is fine sand throughout
- Areas where the soil has loamy and sandy lamellae
- Areas where the subsoil is darker

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:
- The sides of shallow excavations should be reinforced.
- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 8S
Michigan soil management group: 5.3a

65—Sloan silt loam, frequently flooded

Setting

Landform: Backswamps on flood plains
Slope: 0 to 2 percent
Shape of areas: Irregular or elongated
Size of areas: 25 to 80 acres

Typical Profile

Surface layer:
0 to 14 inches—black and very dark gray silt loam

Subsoil:
14 to 32 inches—dark gray and gray, mottled, firm silty clay loam

Substratum:
32 to 60 inches—gray, mottled, stratified loam, clay loam, and silty clay loam

Soil Properties and Qualities

Permeability: Moderately slow
Available water capacity: High
Drainage class: Very poorly drained
Seasonal high water table: At the surface to 1 foot below the surface from November through June
Surface runoff: Very slow or ponded
Flooding: Frequent
Hazard of soil blowing: Moderate

Composition

Sloan soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The very poorly drained, organic Houghton and Carlisle soils in landscape positions similar to those of the Sloan soil

Similar inclusions:

- Areas where the subsoil has less clay

Use and Management

Land use: Dominant use—woodland; other use—pasture

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soil is frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and a planned grazing system help to keep the pasture in good condition.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 3W
Michigan soil management group: L-2c

67—Cohoctah fine sandy loam, occasionally flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Shape of areas: Elongated
Size of areas: 10 to 250 acres

Typical Profile

Surface layer:
0 to 15 inches—black fine sandy loam

Substratum:
15 to 25 inches—brown, mottled fine sandy loam
25 to 38 inches—gray and dark gray, mottled loam
38 to 80 inches—very dark gray silt loam

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: High
Drainage class: Poorly drained
Seasonal high water table: At the surface to 1 foot below the surface from September through May
Surface runoff: Very slow or ponded
Flooding: Occasional
Hazard of soil blowing: Moderate

Composition

Cohoctah soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The very poorly drained, organic Adrian soils in landscape positions similar to those of the Cohoctah soil
- The somewhat poorly drained Algansee soils on low terraces

Similar inclusions:

- Areas where the soil has more clay

Use and Management

Land use: Dominant use—woodland; other use—pasture

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soil is frozen.
- Because of wetness, severe seedling mortality, and plant competition, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Pasture

Major management concerns: Seasonal wetness, overgrazing

Management measures:

- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 2W
Michigan soil management group: L-2c

69—Algansee loamy fine sand, occasionally flooded

Setting

Landform: Flood plains
Slope: 0 to 3 percent
Shape of areas: Elongated
Size of areas: 10 to 210 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark grayish brown loamy fine sand

Substratum:
8 to 15 inches—brown, very friable loamy fine sand
15 to 44 inches—brown and light yellowish brown, mottled sand
44 to 60 inches—very dark gray, mottled loamy fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: 1 to 2 feet below the surface layer from November through May
Surface runoff: Slow
Flooding: Occasional
Hazard of soil blowing: Moderate

Composition

Algansee soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The poorly drained Cohoctah and Glendora soils on first bottoms

Similar inclusions:

- Areas where the soil has an organic subsoil
- Areas where the soil has loamy material at a depth of more than 40 inches

Use and Management

Land use: Dominant use—woodland; other use—pasture

Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soil is frozen.
- Because of wetness, severe seedling mortality, and plant competition, trees generally are not planted on this soil.

Pasture

Major management concerns: Seasonal wetness, overgrazing

Management measures:
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Proper stocking rates and a planned grazing system help to keep the pasture in good condition.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: 4W
Michigan soil management group: L-4c

70—Glendora mucky loamy fine sand, frequently flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Shape of areas: Elongated
Size of areas: 10 to 65 acres

Typical Profile

Surface layer:
0 to 8 inches—black mucky loamy fine sand

Substratum:
8 to 60 inches—gray and very gray sand and loamy fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Very poorly drained
Seasonal high water table: At the surface to 1 foot below the surface from November through June
Surface runoff: Very slow or ponded
Flooding: Frequent
Hazard of soil blowing: Moderate

Composition

Glendora soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The very poorly drained, organic Adrian soils in landscape positions similar to those of the Glendora soil
- The somewhat poorly drained Algansee soils on low terraces

Similar inclusions:
- Areas where the substratum has more clay
- Areas where the soil has loamy material at a depth of more than 40 inches

Use and Management

Land use: Dominant use—woodland; other use—pasture

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- Equipment can be used only during dry summer months and during periods in winter when the soil is frozen.
- Because of wetness, severe seedling mortality, and plant competition, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Pasture

Major management concerns: Seasonal wetness, overgrazing

Management measures:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.

Interpretive Groups

Land capability classification: VIw
Woodland ordination symbol: 3W
Michigan soil management group: L-4c

71—Houghton and Carlisle soils

Setting

Landform: Depressions on lake plains, outwash plains, and ground moraines
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 3 to 600 acres

Typical Profile

Houghton

Surface layer:
0 to 8 inches—very dark brown mucky peat

Subsoil:
8 to 42 inches—black, friable muck

Substratum:
42 to 60 inches—black muck

Carlisle

Surface layer:
0 to 10 inches—black muck

Subsoil:
10 to 42 inches—black, friable muck

Substratum:
42 to 60 inches—black muck

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from September through June
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: None

Composition

Houghton and Carlisle soils and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The poorly drained Granby and Kingsville soils, which are sandy throughout and are in landscape positions similar to those of the Houghton soil

Similar inclusions:
- Areas where the soil has 16 to 51 inches of muck and is underlain by sandy material
- Areas where the soil has 16 to 51 inches of muck and is underlain by loamy material

Use and Management

Land use: Dominant use—woodland; other use—pasture

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- Special harvesting equipment is needed. The equipment can be used only during periods in winter when skid trails and access roads are frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on these soils.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness

Management measures:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 2W
Michigan soil management group: Mc

72—Adrian muck

Setting

Landform: Depressions on ground moraines and outwash plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 3 to 150 acres

Typical Profile

Surface layer:
0 to 12 inches—black muck

Subsoil:
12 to 34 inches—black, friable muck

Substratum:
34 to 60 inches—grayish brown sand

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid in the upper part of the profile and rapid in the lower part
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from November through May
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: None

Composition

Adrian soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The poorly drained Granby and Kingsville and very poorly drained Glendora soils, which are sandy and are in landscape positions similar to those of the Adrian soil

Similar inclusions:
- Areas where the soil is organic throughout
- Areas where the substratum is loamy
- Areas where the soil is flooded

Use and Management

Land use: Dominant use—woodland; other use—pasture

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- Special harvesting equipment is needed. The equipment can be used only during periods in winter when skid trails and access roads are frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness

Management measures:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 2W
Michigan soil management group: M/4c

73—Palms muck

Setting

Landform: Depressions on lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 60 acres

Typical Profile

Surface layer:
0 to 10 inches—black muck

Subsoil:
10 to 18 inches—black and dark reddish brown, friable muck

Substratum:
18 to 21 inches—grayish brown sandy loam
21 to 60 inches—gray and strong brown silt loam

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid in the upper part of the profile and moderately slow in the lower part
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from November through May
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: None

Composition

Palms soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The poorly drained, sandy Granby and Kingsville soils in landscape positions similar to those of the Palms soil

Similar inclusions:
- Areas where the soil is organic throughout
- Areas where the substratum is clayey

Use and Management

Land use: Dominant use—woodland; other use—pasture

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- Special harvesting equipment is needed. The equipment can be used only during periods in winter when skid trails and access roads are frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness

Management measures:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 2W
Michigan soil management group: M/3c

75—Martisco muck

Setting

Landform: Depressions on lake plains and ground moraines
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 3 to 300 acres

Typical Profile

Surface layer:
0 to 10 inches—black muck

Subsoil:
10 to 15 inches—black, friable muck

Substratum:
15 to 60 inches—light gray marl

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid in the upper part of the profile and slow in the lower part
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface from October through June
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: None

Composition

Martisco soil and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The poorly drained Granby soils, which are sandy throughout and are in landscape positions similar to those of the Martisco soil

Similar inclusions:
- Areas where the soil is muck throughout
- Areas where the muck is 20 to 40 inches deep over sandy or loamy material
- Areas where the substratum is sandy or loamy at a depth of 40 to 60 inches
- Areas where the surface and subsurface tiers are muck more than 16 inches thick

Use and Management

Land use: Dominant use—woodland; other use—pasture

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- Special harvesting equipment is needed. The equipment can be used only during periods in winter when skid trails and access roads are frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness

Management measures:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 2W
Michigan soil management group: M/mc

77—Napoleon muck

Setting

Landform: Closed depressions on ground moraines and lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 3 to 70 acres

Typical Profile

Surface layer:
0 to 11 inches—dark reddish brown and black muck

Subsoil:
11 to 50 inches—dark reddish brown and black, friable mucky peat

Substratum:
50 to 60 inches—black mucky peat

Soil Properties and Qualities

Permeability: Moderate or moderately rapid
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from September through June
Surface runoff: Very slow or ponded
Flooding: None
Hazard of soil blowing: None

Composition

Napoleon soil and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The poorly drained Kingsville soils, which are sandy throughout and are in landscape positions similar to those of the Napoleon soil

Similar inclusions:
- Areas where the soil is nonacid
- Areas where the substratum is sandy at a depth of 16 to 51 inches

Use and Management

Land use: Dominant use—woodland; other use—pasture

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- Special harvesting equipment is needed. The equipment can be used only during periods in winter when skid trails and access roads are frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on this soil.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness

Management measures:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.

Interpretive Groups

Land capability classification: VIw
Woodland ordination symbol: 3W
Michigan soil management group: Mc-ay

83—Histosols and Aquents, ponded

Setting

Landform: Depressions on ground moraines
Slope: 0 to 1 percent
Shape of areas: Elongated or irregular
Size of areas: 3 to 100 acres

Typical Profile

Histosols

Texture: 16 to 60 inches of muck, which is underlain by mineral material

Aquents

Texture: Sandy to clayey

Soil Properties and Qualities

Permeability: Variable
Available water capacity: Variable
Drainage class: Very poorly drained
Seasonal high water table: Histosols—1 foot above to 1 foot below the surface from September through June; Aquents—1 foot above to 1 foot below the surface throughout the year
Surface runoff: Ponded
Flooding: None
Hazard of soil blowing: None

Composition

Histosols and Aquents: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The poorly drained Granby and Kingsville soils in landscape positions similar to those of the Histosols and Aquents

Use and Management

Land use: Dominant use—wetland wildlife habitat

Management measures:
- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: None
Michigan soil management group: None

84F—Dune land-Quartzipsamments-Psammaquents complex, nearly level to steep

Setting

Landform: Dune land and Quartzipsamments—dunes; Psammaquents—swales
Slope: 0 to 35 percent
Shape of areas: Irregular or elongated
Size of areas: 100 to 475 acres

Typical Profile

Quartzipsamments

0 to 60 inches—very pale brown fine sand

Psammaquents

0 to 60 inches—light brownish gray fine sand

Soil Properties and Qualities

Quartzipsamments and Psammaquents

Permeability: Rapid
Available water capacity: Low
Drainage class: Quartzipsamments—excessively drained; Psammaquents—poorly drained
Seasonal high water table: Quartzipsamments—at a depth of more than 60 inches; Psammaquents—1 foot above to 1 foot below the surface from October through May
Surface runoff: Quartzipsamments—medium; Psammaquents—very slow or ponded
Flooding: None
Hazard of soil blowing: Quartzipsamments—severe; Psammaquents—none

Composition

Dune land: 45 to 60 percent
Quartzipsamments and similar soils: 25 to 40 percent
Psammaquents and similar soils: 15 to 25 percent

Inclusions

Similar inclusions:

- Areas where the soil has a surface layer

Use and Management

Land use: Dominant use—recreation

Management measures:

- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: None
Michigan soil management group: None

85F—Udorthents-Quartzipsamments complex, very steep

Setting

Landform: Very steep areas on ground moraines and dunes (fig. 6)
Slope: 35 to 85 percent
Shape of areas: Elongated
Size of areas: 3 to 40 acres

Typical Profile

Udorthents

0 to 60 inches—sandy loam to silty clay loam

Quartzipsamments

0 to 60 inches—very pale brown fine sand

Soil Properties and Qualities

Permeability: Udorthents—moderate; Quartzipsamments—rapid
Available water capacity: Udorthents—moderate; Quartzipsamments—low
Drainage class: Udorthents—well drained; Quartzipsamments—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Udorthents—none; Quartzipsamments—severe

Composition

Udorthents: 50 to 65 percent
Quartzipsamments: 35 to 50 percent

Use and Management

Land use: Dominant use—none

- Because these soils are in sensitive areas on stabilizing dunes, uses are limited. Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: None
Michigan soil management group: None

86F—Dune land-Quartzipsamments complex, rolling to very steep

Setting

Landform: Very steep areas on dunes
Slope: 12 to 70 percent
Shape of areas: Irregular or elongated
Size of areas: 60 to 220 acres

Typical Profile

Quartzipsamments

0 to 60 inches—very pale brown fine sand

Soil Properties and Qualities

Quartzipsamments

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained

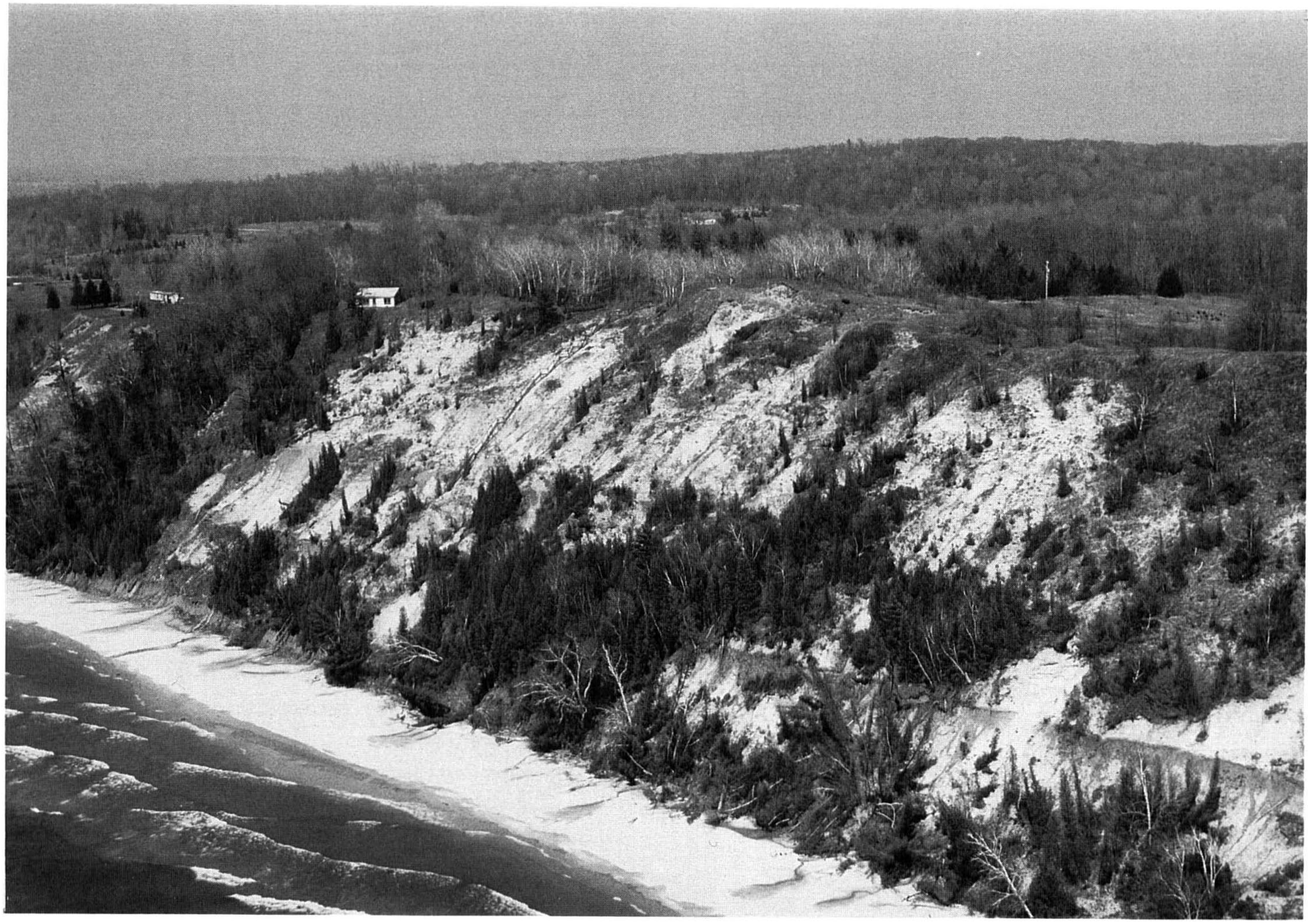

Figure 6.—An area of Udorthents-Quartzipsamments complex, very steep.

Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow to rapid
Flooding: None
Hazard of soil blowing: Severe

Composition

Dune land: 60 to 80 percent
Quartzipsamments: 15 to 40 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- Areas where the soil has a high water table

Use and Management

Land use: Dominant use—recreation
- Because these soils are in sensitive areas on stabilizing dunes, uses are limited. Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: None
Michigan soil management group: None

87—Beaches

Setting

Landform: Areas along Lake Michigan
Shape of areas: Elongated
Size of areas: 10 to 40 acres

Composition

Beaches: 100 percent

Use and Management

Land use: Recreation

Management measures:
- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: None
Michigan soil management group: None

88A—Udipsamments, nearly level

Setting

Landform: Nearly level areas on outwash plains, ground moraines, and lake plains that formerly were excavated for borrow material and have been filled
Slope: 0 to 3 percent
Shape of areas: Irregular
Size of areas: 3 to 80 acres

Typical Profile

0 to 60 inches—pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Udipsamments: 100 percent

Use and Management

Land use: Source of sand

Management measures:
- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: None
Michigan soil management group: None

89A—Udorthents, nearly level

Setting

Landform: Nearly level areas on ground moraines that formerly were excavated for borrow material and have been filled
Slope: 0 to 3 percent
Shape of areas: Irregular
Size of areas: 3 to 30 acres

Typical Profile

0 to 60 inches—sandy loam to silty clay loam

Soil Properties and Qualities

Permeability: Moderate
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: None

Composition

Udorthents and similar soils: 100 percent

Inclusions

Similar inclusions:
- Areas where the surface layer is sandy

Use and Management

Land use: Former use—source of borrow material; current use—none

Management measures:
- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: None
Michigan soil management group: None

91—Pits, sand and gravel

Setting

Landform: Ground moraines
Shape of areas: Irregular
Size of areas: 3 to 100 acres

Composition

Pits: 100 percent

Use and Management

Land use: Source of sand and gravel

Management measures:
- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None

Woodland ordination symbol: None
Michigan soil management group: None

92B—Chelsea fine sand, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on lake plains and glacial deltas
Shape of areas: Irregular
Size of areas: 3 to 125 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown fine sand

Subsoil:
9 to 39 inches—strong brown, yellowish brown, and brownish yellow, loose fine sand
39 to 60 inches—light yellowish brown, loose fine sand that has lamellae of dark brown and strong brown, loose loamy fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Chelsea soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The well drained Arkport soils, which have a loamy subsoil and are in landscape positions similar to those of the Chelsea soil
- The somewhat poorly drained Thetford soils in drainageways and on foot slopes

Similar inclusions:

- Areas where the soil has more than 6 inches of loamy lamellae
- Areas where the soil is sand
- Areas where the soil has loamy material at a depth of more than 40 inches
- Areas where the upper part of the subsoil is darker

Use and Management

Land use: Dominant uses—woodland, cropland; other uses—pasture, building site development

Woodland

Major management concerns: Seeding mortality

Management measures:

- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Cropland

Major management concerns: Soil blowing, seasonal droughtiness, a low content of organic matter

Management measures:

- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Because of the limited available water capacity, most crops should be irrigated.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 5S
Michigan soil management group: 5a

92C—Chelsea fine sand, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines and glacial deltas
Shape of areas: Irregular
Size of areas: 3 to 80 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark grayish brown fine sand

Subsoil:
9 to 39 inches—strong brown, yellowish brown, and brownish yellow, loose fine sand
39 to 60 inches—light yellowish brown, loose fine sand that has lamellae of dark brown and strong brown, loose loamy fine sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Chelsea soil and similar soils: 95 percent
Contrasting inclusions: 5 percent

Inclusions

Contrasting inclusions:
- The well drained Arkport soils, which have a loamy subsoil and are in landscape positions similar to those of the Chelsea soil

Similar inclusions:
- Areas where the soil has more than 6 inches of loamy lamellae
- Areas where the soil is sand
- Areas where the soil has loamy material at a depth of more than 40 inches
- Areas where the upper part of the subsoil is darker

Use and Management

Land use: Dominant use—woodland; other uses—pasture, building site development

Woodland

Major management concerns: Seedling mortality

Management measures:
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:
- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, which causes poor filtering and a hazard of ground-water pollution

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 5S
Michigan soil management group: 5a

96B—Spinks-Tekenink loamy fine sands, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 65 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Tekenink

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsurface layer:
9 to 15 inches—dark yellowish brown loamy fine sand

15 to 35 inches—pale brown loamy fine sand and yellowish red, friable sandy loam
35 to 46 inches—yellowish red, friable sandy loam
Substratum:
46 to 60 inches—yellowish red sandy loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Tekenink—moderate
Available water capacity: Spinks—low; Tekenink—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 50 percent
Tekenink soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Benona soils, which have less than 6 inches of lamellae and are in landscape positions similar to those of the Spinks and Tekenink soils
- The well drained Fern soils, which have a loamy subsoil at a depth of 20 to 40 inches and are in landscape positions similar to those of the Spinks and Tekenink soils

Similar inclusions:
- Areas where the Spinks soil has more than 15 percent gravel
- Areas where the Tekenink soil has more clay in the subsoil

Use and Management

Land use: Dominant use—cropland; other uses—woodland, pasture, building site development

Cropland

Major management concerns: Soil blowing and seasonal droughtiness in areas of both soils, a low content of organic matter in the Spinks soil

Management measures:
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:
- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Moderate permeability in the Tekenink soil

Management measures:
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: 4A
Michigan soil management group: Spinks—4a; Tekenink—3a

96C—Spinks-Tekenink loamy fine sands, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 70 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand
Subsoil:
9 to 18 inches—strong brown, very friable fine sand

18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Tekenink

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsurface layer:
9 to 15 inches—dark yellowish brown, very friable loamy fine sand
15 to 35 inches—pale brown loamy fine sand and yellowish red, friable sandy loam
35 to 46 inches—yellowish red, friable sandy loam

Substratum:
46 to 60 inches—yellowish red sandy loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Tekenink—moderate
Available water capacity: Spinks—low; Tekenink—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 50 percent
Tekenink soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The excessively drained Benona soils, which have less than 6 inches of lamellae in the subsoil and are in landscape positions similar to those of the Spinks and Tekenink soils
- The well drained Fern soils, which have a loamy subsoil at a depth of 20 to 40 inches and are in landscape positions similar to those of the Spinks and Tekenink soils

Similar inclusions:

- Areas where the Spinks soil has more than 15 percent gravel
- Areas where the Tekenink soil has more clay in the subsoil

Use and Management

Land use: Dominant use—cropland; other uses—woodland, pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, and seasonal droughtiness in areas of both soils; a low content of organic matter in the Spinks soil

Management measures:

- Crop rotations that include grasses, legumes, and small grain help to control runoff and water erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Moderate permeability in the Tekenink soil

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4A
Michigan soil management group: Spinks—4a; Tekenink—3a

96D—Spinks-Tekenink loamy fine sands, 12 to 18 percent slopes

Setting

Landform: Hilly areas on end moraines and ground moraines
Shape of areas: Irregular
Size of areas: 10 to 70 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Tekenink

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsurface layer:
9 to 15 inches—dark yellowish brown loamy fine sand
15 to 35 inches—pale brown loamy fine sand and yellowish red, friable sandy loam
35 to 46 inches—yellowish red, friable sandy loam

Substratum:
46 to 60 inches—yellowish red sandy loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Tekenink—moderate
Available water capacity: Spinks—low; Tekenink—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 50 percent
Tekenink soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The excessively drained Benona soils, which have less than 6 inches of lamellae in the subsoil and are in landscape positions similar to those of the Spinks and Tekenink soils
- The well drained Fern soils, which have a loamy subsoil at a depth of 20 to 40 inches and are in landscape positions similar to those of the Spinks and Tekenink soils

Similar inclusions:
- Areas where the Spinks soil has more than 15 percent gravel
- Areas where the Tekenink soil has more clay in the subsoil

Use and Management

Land use: Dominant use—cropland; other uses—woodland, pasture, building site development

Cropland

Major management concerns: Water erosion, soil blowing, and seasonal droughtiness in areas of both soils; a low content of organic matter in the Spinks soil

Management measures:
- Crop rotations that include grasses, legumes, and small grain help to control runoff and water erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing

Management measures:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:
- The sides of shallow excavations should be reinforced.
- Because of the slope, this soil is poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Slope

Management measures:
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 4A
Michigan soil management group: Spinks—4a; Tekenink—3a

96E—Spinks-Tekenink loamy fine sands, 18 to 35 percent slopes

Setting

Landform: Steep areas on end moraines
Shape of areas: Irregular or elongated
Size of areas: 10 to 70 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Tekenink

Surface layer:
0 to 9 inches—dark brown loamy fine sand

Subsurface layer:
9 to 15 inches—dark yellowish brown, very friable loamy fine sand
15 to 35 inches—pale brown loamy fine sand and yellowish red, friable sandy loam
35 to 46 inches—yellowish red, friable sandy loam

Substratum:
46 to 60 inches—yellowish red sandy loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Tekenink—moderate
Available water capacity: Spinks—low; Tekenink—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 50 percent
Tekenink soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The excessively drained Benona soils, which have less than 6 inches of lamellae in the subsoil and are in landscape positions similar to those of the Spinks and Tekenink soils
- The well drained Fern soils, which have a loamy subsoil at a depth of 20 to 40 inches and are in landscape positions similar to those of the Spinks and Tekenink soils

Similar inclusions:
- Areas where the Spinks soil has more than 15 percent gravel
- Areas where the Tekenink soil has more clay in the subsoil

Use and Management

Land use: Dominant use—woodland; other use—building site development

Woodland

Major management concerns: Erosion hazard, equipment limitation

Management measures:
- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.

Buildings

Major management concerns: The instability of cutbanks, slope
- Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope
- Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 4R
Michigan soil management group: Spinks—4a; Tekenink—3a

97—Kerston and Carlisle mucks, frequently flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Shape of areas: Elongated
Size of areas: 100 to 1,000 acres

Typical Profile

Kerston

Surface layer:
0 to 13 inches—black muck

Subsoil:
13 to 26 inches—black, friable muck
26 to 33 inches—light brownish gray, loose sand

Substratum:
33 to 46 inches—black, friable muck
46 to 60 inches—light brownish gray sand

Carlisle

Surface layer:
0 to 10 inches—black muck

Subsoil:
10 to 42 inches—black, friable muck

Substratum:
42 to 60 inches—black muck

Soil Properties and Qualities

Permeability: Kerston—moderately slow to moderately rapid in the mucky layers and rapid in the sandy layers; Carlisle—moderately slow to moderately rapid
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from September through June
Surface runoff: Very slow to ponded
Flooding: Frequent
Hazard of soil blowing: None

Composition

Kerston and Carlisle soils and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The very poorly drained Glendora soils, which are sandy throughout and are in landscape positions similar to those of the Kerston and Carlisle soils
- The very poorly drained Sloan soils, which have a loamy subsoil and are in landscape positions similar to those of the Kerston and Carlisle soils

Similar inclusions:
- Areas where the Carlisle soil has a sandy substratum
- Areas where the subsoil has thin layers of marl

Use and Management

Land use: Dominant use—woodland; other use—wildlife habitat

Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- Special harvesting equipment is needed. The equipment can be used only during periods in winter when skid trails and access roads are frozen.
- Because of wetness and severe seedling mortality, trees generally are not planted on these soils.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 2W
Michigan soil management group: Kerston—L-Mc; Carlisle—Mc

98B—Spinks-Scalley complex, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 150 acres

Typical Profile

Spinks

Surface layer:

0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:

9 to 18 inches—strong brown, very friable loamy fine sand

18 to 24 inches—brown, loose fine sand

24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Scalley

Surface layer:

0 to 6 inches—dark grayish brown fine sandy loam

Subsoil:

6 to 22 inches—brown fine sandy loam and reddish brown, firm clay loam

22 to 34 inches—reddish brown, firm clay loam

Substratum:

34 to 80 inches—yellowish brown, loose sand that has a few lamellae of dark brown sandy loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Scalley—moderately slow in the upper part of the profile and rapid in the lower part

Available water capacity: Spinks—low; Scalley—moderate

Drainage class: Well drained

Seasonal high water table: At a depth of more than 60 inches

Surface runoff: Very slow

Flooding: None

Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 55 percent
Scalley soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona and Capac soils in drainageways and on foot slopes
- The well drained Gowdy soils, which have a clayey subsoil and substratum and are in landscape positions similar to those of the Spinks and Scalley soils

Similar inclusions:

- Areas where the subsoil in the Scalley soil has more clay
- Areas where the subsoil in the Scalley soil has less clay
- Areas where the subsoil in the Spinks soil has less than 6 inches of lamellae
- Areas where the lower part of the subsoil and the substratum in the Spinks soil have 15 or more percent gravel

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Soil blowing on both soils, seasonal droughtiness and a low content of organic matter in the Spinks soil

Management measures:

- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness in the Spinks soil, overgrazing on both soils

Management measures:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks

Management measures:

- The sides of shallow excavations should be reinforced.

Septic tank absorption fields

Major management concerns: Moderately slow permeability in the lower part of the subsoil of the Scalley soil; rapid permeability in the substratum of the Scalley soil, which causes poor filtering and a hazard of ground-water pollution

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: Spinks—4A; Scalley—3A
Michigan soil management group: Spinks—4a; Scalley—3/5a

98C—Spinks-Scalley complex, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Scalley

Surface layer:
0 to 6 inches—dark grayish brown fine sandy loam

Subsoil:
6 to 22 inches—brown fine sandy loam and reddish brown, firm clay loam
22 to 34 inches—reddish brown, firm clay loam

Substratum:
34 to 80 inches—yellowish brown, loose sand that has a few lamellae of dark brown sandy loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Scalley—moderately slow in the upper part of the profile and rapid in the lower part
Available water capacity: Spinks—low; Scalley—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 55 percent
Scalley soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Arkona soils in drainageways and on foot slopes
- The well drained Gowdy soils, which have a clayey subsoil and substratum and are in landscape positions similar to those of the Spinks and Scalley soils

Similar inclusions:
- Areas where the subsoil in the Scalley soil has more clay
- Areas where the subsoil in the Scalley soil has less clay
- Areas where the subsoil in the Spinks soil has less than 6 inches of lamellae
- Areas where the subsoil in the Spinks soil has 15 or more percent gravel

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion and soil blowing on both soils, seasonal droughtiness and a low content of organic matter in the Spinks soil

Management measures:
- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Applying a system of conservation tillage, establishing windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.
- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness in the Spinks soil, overgrazing on both soils

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Moderately slow permeability in the lower part of the subsoil of the Scalley soil; rapid permeability in the substratum of the Scalley soil, which causes poor filtering and a hazard of ground-water pollution

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Spinks—4A; Scalley—3A
Michigan soil management group: Spinks—4a; Scalley—3/5a

98D—Spinks-Scalley complex, 12 to 18 percent slopes

Setting

Landform: Hilly areas on ground moraines and end moraines
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Typical Profile

Spinks

Surface layer:
0 to 9 inches—very dark grayish brown loamy fine sand

Subsoil:
9 to 18 inches—strong brown, very friable fine sand
18 to 24 inches—brown, loose fine sand
24 to 60 inches—pale brown, loose sand that has lamellae of dark brown, very friable loamy sand

Scalley

Surface layer:
0 to 6 inches—dark grayish brown fine sandy loam

Subsoil:
6 to 22 inches—brown fine sandy loam and reddish brown, firm clay loam
22 to 34 inches—reddish brown, firm clay loam

Substratum:
34 to 80 inches—yellowish brown, loose sand that has a few lamellae of dark brown sandy loam

Soil Properties and Qualities

Permeability: Spinks—moderately rapid; Scalley—moderately slow in the upper part of the profile and rapid in the lower part
Available water capacity: Spinks—low; Scalley—moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Moderate

Composition

Spinks soil and similar soils: 40 to 55 percent
Scalley soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The well drained Gowdy soils, which have a clayey subsoil and substratum and are in landscape positions similar to those of the Spinks and Scalley soils

Similar inclusions:

- Areas where the subsoil in the Scalley soil has more clay
- Areas where the subsoil in the Scalley soil has less clay
- Areas where the subsoil in the Spinks soil has less than 6 inches of lamellae
- Areas where the subsoil in the Spinks soil has 15 or more percent gravel

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion and soil blowing on both soils, seasonal droughtiness and a low content of organic matter in the Spinks soil

Management measures:

- Crop rotations that include close-growing crops, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive erosion.
- Applying a system of conservation tillage, establishing

windbreaks, planting vegetative barriers of rye, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing.

- Leaving crop residue on the surface and adding other organic material help to conserve moisture.
- Inclusion of green manure crops in the cropping sequence, no-till planting, and crop residue management increase the content of organic matter.
- Properly shaping and maintaining grassed waterways can help to remove runoff from fields safely.
- Timing fertilizer applications according to the nutrient requirements of the crops, using split applications, and applying the fertilizer in bands can reduce the risk of nutrient leaching.
- Because of the need to protect ground water, the amount of nutrients added when manure and fertilizer are applied should not exceed the nutrient requirements of the crops.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness in the Spinks soil, overgrazing on both soils

Management measures:

- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: The instability of cutbanks, slope

Management measures:

- The sides of shallow excavations should be reinforced.
- Because of the slope, these soils are poorly suited to building site development without extensive land shaping.

Septic tank absorption fields

Major management concerns: Moderately slow permeability in the lower part of the subsoil of the Scalley soil; rapid permeability in the substratum of the Scalley soil, which causes poor filtering and a hazard of ground-water pollution; the slope of both soils

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.
- Land shaping, pressurizing the absorption field, and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Spinks—4A; Scalley—3A
Michigan soil management group: Spinks—4a; Scalley—3/5a

99B—Nappanee-Hoytville silt loams, 0 to 4 percent slopes

Setting

Landform: Nappanee—nearly level and undulating areas on ground moraines; Hoytville—depressions on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 720 acres

Typical Profile

Nappanee

Surface layer:
0 to 9 inches—very dark gray silt loam

Subsoil:
9 to 23 inches—dark yellowish brown and brown, mottled, firm silty clay and clay
23 to 60 inches—brown, mottled silty clay

Hoytville

Surface layer:
0 to 9 inches—very dark gray silt loam

Subsoil:
9 to 44 inches—greenish gray, dark gray, and gray, mottled, firm silty clay

Substratum:
44 to 60 inches—gray, mottled clay

Soil Properties and Qualities

Permeability: Slow
Available water capacity: Moderate
Drainage class: Nappanee—somewhat poorly drained; Hoytville—very poorly drained
Seasonal high water table: Nappanee—perched 1 to 2 feet below the surface from November through May; Hoytville—perched 1 foot above to 1 foot below the surface from January through April
Surface runoff: Nappanee—medium; Hoytville—very slow or ponded
Flooding: None
Hazard of soil blowing: None

Composition

Nappanee soil and similar soils: 40 to 60 percent
Hoytville soil and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Nappanee soil
- The well drained Claybanks soils in the higher landscape positions

Similar inclusions:

- Areas where the subsoil has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion on the Nappanee soil; seasonal wetness, slow permeability, compaction, tilth in the surface layer, and soil blowing in areas of both soils

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Surface and subsurface drainage systems are needed to reduce the wetness.
- Because of slow permeability, subsurface drains should be closely spaced.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Conservation tillage, vegetative barriers, and cover crops help to control soil blowing.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: Equipment limitation and windthrow hazard on both soils, seedling mortality on the Hoytville soil

Management measures:

- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soils are dry, or midwinter, when the soils are frozen.
- Special site preparation, such as bedding before planting, can reduce the seedling mortality rate.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced, such as selective cutting and strip cutting.

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.

Buildings

Major management concerns: Seasonal wetness and shrink-swell potential in the Nappanee soil, ponding on the Hoytville soil

- Because of the ponding, the Hoytville soil is generally unsuited to building site development.

Management measures:

- A surface or subsurface drainage system helps to lower the water table.
- Buildings can be constructed on well compacted fill material that raises the site a sufficient distance above the water table.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Seasonal wetness in the Nappanee soil, ponding on the Hoytville soil, slow permeability in both soils

Management measures:

- A subsurface drainage system helps to lower the water table.
- Mounding or adding suitable fill material helps to raise the absorption field above the water table.
- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Nappanee—4C; Hoytville—3W
Michigan soil management group: Nappanee—1b; Hoytville—1c

100B—Nappanee silt loam, 0 to 4 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 30 to 210 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark gray silt loam

Subsoil:
9 to 23 inches—dark yellowish brown and brown, mottled, firm silty clay and clay
23 to 60 inches—brown, mottled silty clay

Soil Properties and Qualities

Permeability: Slow
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Seasonal high water table: Perched 1 to 2 feet below the surface from November through May
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: None

Composition

Nappanee soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Arkona soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Nappanee soil
- The poorly drained Hoytville soils in depressions
- The well drained Claybanks soils in the higher landscape positions

Similar inclusions:
- Areas where the subsoil has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, seasonal wetness, slow permeability, compaction, tilth in the surface layer

Management measures:
- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Surface and subsurface drainage systems are needed to reduce the wetness.
- Because of slow permeability, subsurface drains should be closely spaced.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: Equipment limitation, windthrow hazard

Management measures:
- Skidders should not be used during wet periods, when ruts form easily.
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- The only hay and pasture plants that should be seeded are those that can withstand periodic inundation and seasonal wetness.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Seasonal wetness

Management measures:
- Buildings can be constructed on well compacted fill material that raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Seasonal wetness, slow permeability

Management measures:
- Mounding or adding suitable fill material helps to raise the absorption field above the water table.

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4C
Michigan soil management group: 1b

101B—Claybanks silt loam, 1 to 6 percent slopes

Setting

Landform: Nearly level and undulating areas on ground moraines
Shape of areas: Irregular
Size of areas: 5 to 850 acres

Typical Profile

Surface layer:
0 to 7 inches—very dark grayish brown silt loam

Subsoil:
7 to 11 inches—light brownish gray silt loam and reddish brown, mottled, firm silty clay
11 to 20 inches—reddish brown and brown, firm clay

Substratum:
20 to 60 inches—pale brown clay

Soil Properties and Qualities

Permeability: Slow
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: None

Composition

Claybanks soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona and Nappanee soils in drainageways and on foot slopes
- The poorly drained Hoytville soils in depressions
- The well drained Gowdy soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Claybanks soil

Similar inclusions:

- Areas where the surface layer is moderately eroded
- Areas where the subsoil has less clay
- Areas where the soil is moderately well drained

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, seasonal wetness, slow permeability, compaction, tilth in the surface layer

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Surface and subsurface drainage systems are needed to reduce the wetness.
- Because of slow permeability, subsurface drains should be closely spaced.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Seasonal wetness, compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing and water erosion, maintain plant density and hardiness, and keep the pasture in good condition.

Buildings

Major management concerns: Shrink-swell potential

Management measures:

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Slow permeability, seasonal wetness

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIe

Woodland ordination symbol: 4A
Michigan soil management group: 1a

101C—Claybanks silt loam, 6 to 12 percent slopes

Setting

Landform: Rolling areas on ground moraines
Shape of areas: Irregular
Size of areas: 10 to 40 acres

Typical Profile

Surface layer:
0 to 7 inches—very dark grayish brown silt loam

Subsoil:
7 to 11 inches—light brownish gray silt and reddish brown, mottled, firm silty clay
11 to 20 inches—reddish brown and brown, firm clay

Substratum:
20 to 60 inches—pale brown clay

Soil Properties and Qualities

Permeability: Slow
Available water capacity: Moderate
Drainage class: Well drained
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: None

Composition

Claybanks soil and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Arkona and Nappanee soils in drainageways and on foot slopes
- The well drained Gowdy soils, which have a sandy surface layer and subsoil and are in landscape positions similar to those of the Claybanks soil

Similar inclusions:

- Areas where the soil is moderately eroded
- Areas where the subsoil has less clay

Use and Management

Land use: Dominant uses—cropland, woodland; other uses—pasture, building site development

Cropland

Major management concerns: Water erosion, slow permeability, compaction, tilth in the surface layer

Management measures:

- A system of conservation tillage that leaves crop residue on the surface helps to control water erosion, helps to prevent crusting during periods of heavy rainfall, and increases the rate of water infiltration.
- Minimizing tillage and tilling and harvesting at the proper moisture content help to prevent excessive compaction and maintain tilth.
- Crop rotations that include legumes reduce the need for commercial fertilizer. Sod-based rotations control runoff and thus significantly reduce the loss of dissolved and particulate nitrogen and phosphorus.

Woodland

Major management concerns: None

Pasture

Major management concerns: Compaction, overgrazing

Management measures:

- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Proper stocking rates and rotation grazing or a planned grazing system help to keep the pasture in good condition.

Buildings

Major management concerns: Shrink-swell potential, slope

Management measures:

- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Slow permeability

Management measures:

- Backfilling the trenches with porous material helps to compensate for the restricted permeability.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4A
Michigan soil management group: 1a

210B—Typic Udipsamments, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on outwash plains
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 80 to 600 acres

Reference Profile

Organic mat:
0 to 1 inch—undecomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsoil:
3 to 36 inches—yellowish brown and brownish yellow, loose sand

Substratum:
36 to 99 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, in drainageways and on foot slopes
- The very poorly drained Typic Haplaquods, sandy, and Medisaprists, euic, in depressions

Similar inclusions:
- Areas where the substratum is banded
- Areas of soils that have a leached subsurface layer
- Areas where bright mottles are in the lower part of the subsoil and in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 2S
Michigan soil management group: 5.7a
Primary plant association: Black oak-white oak-blueberry

210C—Typic Udipsamments, rolling

Setting

Landform: Rolling areas on outwash plains and moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Organic mat:
0 to 1 inch—undecomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsoil:
3 to 36 inches—yellowish brown and brownish yellow, loose sand

Substratum:
36 to 99 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
- The well drained Alfic Haplorthods, sandy over loamy, which have a loamy substratum
- The somewhat excessively drained Entic Haplorthods, sandy, loamy substratum, which have a subsoil that is darker than that of the Typic Udipsamments, have a loamy substratum, and are in landscape positions similar to those of the Typic Udipsamments

Similar inclusions:
- Areas where the substratum is banded
- Areas of soils that have a leached subsurface layer
- Areas where bright mottles are in the lower part of the subsoil and in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 2S
Michigan soil management group: 5.7a
Primary plant association: Black oak-white oak-blueberry

210D—Typic Udipsamments, hilly

Setting

Landform: Hilly areas on moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Organic mat:
0 to 1 inch—undecomposed hardwood and coniferous leaf litter
Surface layer:
1 to 3 inches—very dark gray sand
Subsoil:
3 to 36 inches—yellowish brown and brownish yellow, loose sand
Substratum:
36 to 99 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The well drained Alfic Haplorthods, sandy over loamy, which have a loamy substratum
- The somewhat excessively drained Entic Haplorthods, sandy, loamy substratum, which have a subsoil that is darker than that of the Typic Udipsamments and are in landscape positions similar to those of the Typic Udipsamments

Similar inclusions:

- Areas where the substratum is banded
- Areas of soils that have a leached subsurface layer
- Areas where bright mottles are in the lower part of the subsoil and in the substratum

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 2R
Michigan soil management group: 5.7a
Primary plant association: Black oak-white oak-blueberry

211B—Typic Udipsamments, banded substratum, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on outwash plains and moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 80 to 600 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsoil:
2 to 20 inches—dark yellowish brown, loose sand
20 to 30 inches—yellowish brown, loose sand

Substratum:
30 to 45 inches—light yellowish brown sand
45 to 65 inches—light yellowish brown sand that has bands of yellowish brown loamy sand
65 to 99 inches—light yellowish brown sand that has strata of fine sand, coarse sand, and loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, in drainageways and on foot slopes
- The very poorly drained Typic Haplaquods, sandy, and Medisaprists, euic, in depressions
- The somewhat excessively drained Entic Haplorthods, sandy, loamy substratum
- The excessively drained Entic Haplorthods, sandy, which have a subsoil that is darker than that of the Typic Udipsamments and are sandy throughout

Similar inclusions:
- Areas where the substratum is not banded
- Areas where the substratum has bright mottles

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 3S
Michigan soil management group: 5.7a
Primary plant association: Black oak-white oak-blueberry

211C—Typic Udipsamments, banded substratum, rolling

Setting

Landform: Rolling areas on moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 80 to 600 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsoil:
2 to 20 inches—dark yellowish brown, loose sand
20 to 30 inches—yellowish brown, loose sand

Substratum:
30 to 45 inches—light yellowish brown sand
45 to 65 inches—light yellowish brown sand that has bands of yellowish brown loamy sand
65 to 99 inches—light yellowish brown sand that has strata of fine sand, coarse sand, and loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, in drainageways and on foot slopes
- The very poorly drained Typic Haplaquods, sandy, and Medisaprists, euic, in depressions
- The somewhat excessively drained Entic Haplorthods, sandy, loamy substratum
- The excessively drained Entic Haplorthods, sandy, which have a subsoil that is darker than that of the Typic Udipsamments and are sandy throughout

Similar inclusions:
- Areas where the substratum is not banded
- Areas where the substratum has bright mottles

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 3S
Michigan soil management group: 5.7a
Primary plant association: Black oak-white oak-blueberry

212B—Typic Udipsamments, very deep water table, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on outwash plains
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 80 to 600 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark gray sand
Subsoil:
3 to 8 inches—brown sand
8 to 20 inches—strong brown, loose sand
20 to 25 inches—yellowish brown, loose sand
Substratum:
25 to 60 inches—light yellowish brown sand
60 to 180 inches—yellowish brown, mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: 5 to 15 feet below the surface throughout the year
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Typic Udipsamments and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, in drainageways and on foot slopes
- The very poorly drained Typic Haplaquods, sandy, and Medisaprists in depressions

Similar inclusions:

- Areas that are banded at a depth of more than 40 inches
- Areas of soils that have a leached subsurface layer
- Areas where bright mottles are in the lower part of the subsoil and in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 3S
Michigan soil management group: 5.3a
Primary plant association: Black oak-white oak-blueberry

213B—Argic Udipsamments, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on outwash plains and moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 80 to 400 acres

Reference Profile

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter
Surface layer:
1 to 3 inches—very dark grayish brown sand
Subsoil:
3 to 18 inches—dark yellowish brown, very friable sand
18 to 31 inches—yellowish brown, loose sand
31 to 99 inches—light yellowish brown sand that has lamellae of strong brown and brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow

Flooding: None
Hazard of soil blowing: Severe

Composition

Argic Udipsamments and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, in drainageways and on foot slopes
- The very poorly drained Typic Haplaquods, sandy, and Medisaprists, euic, in depressions

Similar inclusions:

- Areas of soils that have a leached subsurface layer
- Areas where bright mottles are in the lower part of the subsoil and in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: None
Michigan soil management group: 5.3a
Primary plant association: Black oak-white oak-blueberry

213C—Argic Udipsamments, rolling

Setting

Landform: Rolling areas on moraines
Slope: 12 to 18 percent
Shape of areas: Irregular
Size of areas: 80 to 400 acres

Reference Profile

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark grayish brown sand

Subsoil:
3 to 18 inches—dark yellowish brown, very friable sand
18 to 31 inches—yellowish brown, loose sand
31 to 99 inches—light yellowish brown sand that has lamellae of strong brown and brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Argic Udipsamments and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, in drainageways and on foot slopes
- The very poorly drained Typic Haplaquods, sandy, and Medisaprists, euic, in depressions

Similar inclusions:

- Areas of soils that have a leached subsurface layer
- Areas where bright mottles are in the lower part of the subsoil and in the substratum

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: None
Michigan soil management group: 5.3a
Primary plant association: Black oak-white oak-blueberry

213D—Argic Udipsamments, hilly

Setting

Landform: Hilly areas on moraines
Slope: 18 to 35 percent
Shape of areas: Irregular
Size of areas: 80 to 400 acres

Reference Profile

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark grayish brown sand

Subsoil:
3 to 18 inches—dark yellowish brown, very friable sand
18 to 31 inches—yellowish brown, loose sand
31 to 99 inches—light yellowish brown sand that has lamellae of strong brown and brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Argic Udipsamments and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, in drainageways and on foot slopes
- The very poorly drained Typic Haplaquods, sandy, in depressions

Similar inclusions:

- Areas of soils that have a leached subsurface layer
- Areas where bright mottles are in the lower part of the subsoil and in the substratum

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: None
Michigan soil management group: 5.3a
Primary plant association: Black oak-white oak-blueberry

220B—Entic Haplorthods, sandy, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on outwash plains and ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 600 acres

Reference Profile

Organic mat:
0 to 1 inch—partially decomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 48 inches—brown, strong brown, and yellowish brown, loose sand

Substratum:
48 to 99 inches—pale brown and light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, and Aquic Udipsamments in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very

poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the substratum is loamy
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

220C—Entic Haplorthods, sandy, rolling

Setting

Landform: Rolling areas on moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 600 acres

Reference Profile

Organic mat:
0 to 1 inch—partially decomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand

Substratum:
48 to 99 inches—pale brown and light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, and Aquic Udipsamments in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the substratum is loamy
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

220D—Entic Haplorthods, sandy, hilly

Setting

Landform: Hilly areas on ground moraines and end moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 40 to 400 acres

Reference Profile

Organic mat:
0 to 1 inch—partially decomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand

Substratum:
49 to 99 inches—pale brown and light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The well drained Alfic Haplorthods, sandy over loamy, and the somewhat excessively drained Entic Haplorthods, sandy, loamy substratum, which are in landscape positions similar to those of the Entic Haplorthods

Similar inclusions:

- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

220E—Entic Haplorthods, sandy, steep and very steep

Setting

Landform: Steep and very steep areas on end moraines
Slope: 30 to 50 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Organic mat:
0 to 1 inch—partially decomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand

Substratum:
48 to 99 inches—pale brown and light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent

Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The well drained Alfic Haplorthods, sandy over loamy, and the somewhat excessively drained Entic Haplorthods, sandy, loamy substratum, which are in landscape positions similar to those of the Entic Haplorthods

Similar inclusions:

- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Minimizing surface disturbance helps to control erosion.
- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

221B—Entic Haplorthods, sandy, coarse-loamy banded substratum, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 600 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—grayish brown sand

Subsoil:
4 to 15 inches—dark brown, loose sand
15 to 30 inches—strong brown, loose sand

Substratum:
30 to 60 inches—light yellowish brown sand
60 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand
75 to 85 inches—brown loamy sand
85 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, and Aquic Udipsamments in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas of soils that have a fine textured, banded substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

221C—Entic Haplorthods, sandy, coarse-loamy banded substratum, rolling

Setting

Landform: Rolling areas on ground moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 600 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—grayish brown sand

Subsoil:
4 to 15 inches—dark brown, loose sand
15 to 30 inches—strong brown, loose sand

Substratum:
30 to 60 inches—light yellowish brown sand
60 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand
75 to 85 inches—brown loamy sand
85 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, and Aquic Udipsamments in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions

Similar inclusions:
- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas of soils that have a fine textured, banded substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

221D—Entic Haplorthods, sandy, coarse-loamy banded substratum, hilly

Setting

Landform: Hilly areas on ground moraines and end moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—grayish brown sand

Subsoil:
4 to 15 inches—dark brown, loose sand
15 to 30 inches—strong brown, loose sand

Substratum:
30 to 60 inches—light yellowish brown sand
60 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand
75 to 85 inches—brown loamy sand
85 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The well drained Alfic Haplorthods, sandy over loamy, and the somewhat excessively drained Entic Haplorthods, sandy, loamy substratum, which are in landscape positions similar to those of the Entic Haplorthods, sandy, coarse-loamy banded substratum, hilly

Similar inclusions:

- Areas of soils that have a fine textured, banded substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard, equipment limitation, seedling mortality

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

221E—Entic Haplorthods, sandy, coarse-loamy banded substratum, steep and very steep

Setting

Landform: Steep and very steep areas on end moraines
Slope: 30 to 50 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—grayish brown, loose sand

Subsoil:
4 to 15 inches—dark brown, loose sand
15 to 30 inches—strong brown, loose sand

Substratum:
30 to 60 inches—light yellowish brown sand
60 to 75 inches—light yellowish brown sand that has bands of dark yellowish brown loamy sand
75 to 85 inches—brown loamy sand
85 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The well drained Alfic Haplorthods, sandy over loamy, and the somewhat excessively drained Entic Haplorthods, sandy, loamy substratum, which are in landscape positions similar to those of the Entic Haplorthods, sandy, coarse-loamy banded substratum, steep and very steep

Similar inclusions:
- Areas of soils that have a fine textured, banded substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:
- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

222B—Entic Haplorthods, sandy, very deep water table, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on outwash plains
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsurface layer:
3 to 5 inches—grayish brown sand

Subsoil:
5 to 12 inches—dark brown, loose sand
12 to 18 inches—strong brown, loose sand
18 to 35 inches—yellowish brown, loose sand

Substratum:
35 to 65 inches—light yellowish brown sand
65 to 80 inches—light yellowish brown, mottled sand
80 to 90 inches—yellowish brown, mottled sand
90 to 99 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: 5 to 15 feet below the surface throughout the year
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions

Similar inclusions:
- Areas where the substratum is fine textured
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a

Primary plant association: Mixed oak-red maple-starflower

222C—Entic Haplorthods, sandy, very deep water table, rolling

Setting

Landform: Rolling areas on outwash plains
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark gray sand

Subsurface layer:
3 to 5 inches—grayish brown sand

Subsoil:
5 to 12 inches—dark brown, loose sand
12 to 18 inches—strong brown, loose sand
18 to 35 inches—yellowish brown, loose sand

Substratum:
35 to 65 inches—light yellowish brown sand
65 to 80 inches—light yellowish brown, mottled sand
80 to 90 inches—yellowish brown, mottled sand
90 to 99 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: 5 to 15 feet below the surface throughout the year
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where the substratum is fine textured
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

223B—Entic Haplorthods, sandy, fine-loamy banded substratum, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 5 inches—pale brown sand

Subsoil:
5 to 10 inches—brown, loose sand
10 to 15 inches—strong brown, loose sand
15 to 35 inches—yellowish brown, loose sand

Substratum:
35 to 55 inches—strong brown sand that has bands of dark yellowish brown fine sandy loam
55 to 70 inches—yellowish brown loamy sand
70 to 80 inches—light yellowish brown sand
80 to 90 inches—reddish brown sandy clay loam
90 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet

Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

223C—Entic Haplorthods, sandy, fine-loamy banded substratum, rolling

Setting

Landform: Rolling areas on ground moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 5 inches—pale brown sand

Subsoil:
5 to 10 inches—brown, loose sand
10 to 15 inches—strong brown, loose sand
15 to 35 inches—yellowish brown, loose sand

Substratum:
35 to 55 inches—strong brown sand that has bands of dark yellowish brown fine sandy loam
55 to 70 inches—yellowish brown loamy sand
70 to 80 inches—light yellowish brown sand
80 to 90 inches—reddish brown sandy clay loam
90 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a

Primary plant association: Mixed oak-red maple-starflower

223D—Entic Haplorthods, sandy, fine-loamy banded substratum, hilly

Setting

Landform: Hilly areas on ground moraines and end moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 5 inches—pale brown sand

Subsoil:
5 to 10 inches—brown, loose sand
10 to 15 inches—strong brown, loose sand
15 to 35 inches—yellowish brown, loose sand

Substratum:
35 to 55 inches—strong brown sand that has bands of dark yellowish brown fine sandy loam
55 to 70 inches—yellowish brown loamy sand
70 to 80 inches—light yellowish brown sand
80 to 90 inches—reddish brown sandy clay loam
90 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
- The well drained Alfic Haplorthods, sandy over loamy, and Entic Haplorthods, sandy, loamy substratum, which are in landscape positions similar to those of the Entic Haplorthods, sandy, fine-loamy banded substratum, hilly
- The somewhat excessively drained Entic Haplorthods, sandy, dark subsoil, loamy substratum, which are in landscape positions similar to those of the Entic Haplorthods, sandy, fine-loamy banded substratum, hilly

Similar inclusions:
- Areas of soils that have a coarse textured, banded substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:
- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

223E—Entic Haplorthods, sandy, fine-loamy banded substratum, steep and very steep

Setting

Landform: Steep and very steep areas on end moraines
Slope: 30 to 50 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 5 inches—pale brown sand

Subsoil:
5 to 10 inches—brown, loose sand

10 to 15 inches—strong brown, loose sand
15 to 35 inches—yellowish brown, loose sand

Substratum:
35 to 55 inches—strong brown sand that has bands of dark yellowish brown fine sandy loam
55 to 70 inches—yellowish brown loamy sand
70 to 80 inches—light yellowish brown sand
80 to 90 inches—reddish brown sandy clay loam
90 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:

- The well drained Alfic Haplorthods, sandy over loamy, and Entic Haplorthods, sandy, loamy substratum, which are in landscape positions similar to those of the Entic Haplorthods, sandy, fine-loamy banded substratum, steep and very steep
- The somewhat excessively drained Entic Haplorthods, sandy, dark subsoil, loamy substratum, which are in landscape positions similar to those of the Entic Haplorthods, sandy, fine-loamy banded substratum, steep and very steep

Similar inclusions:

- Areas of soils that have a coarse textured, banded substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

224B—Entic Haplorthods, sandy, deep water table, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on outwash plains
Slope: 0 to 4 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Surface layer:
0 to 4 inches—very dark gray sand

Subsurface layer:
4 to 7 inches—grayish brown sand

Subsoil:
7 to 11 inches—dark brown, loose sand
11 to 18 inches—strong brown, loose sand
18 to 30 inches—dark yellowish brown, loose sand

Substratum:
30 to 40 inches—yellowish brown sand
40 to 55 inches—brownish yellow, mottled sand
55 to 70 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: 3 to 5 feet below the surface throughout the year
Surface runoff: Very slow

Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:
- The very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions

Similar inclusions:
- Areas of soils that have a banded substratum
- Areas where the surface layer is loamy sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 4S
Michigan soil management group: 5a
Primary plant association: Mixed oak-red maple-starflower

225B—Entic Haplorthods, sandy, loamy substratum, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—grayish brown sand

Subsoil:
4 to 10 inches—dark brown, loose sand
10 to 35 inches—yellowish brown, loose sand

Substratum:
35 to 55 inches—strong brown sand
55 to 65 inches—reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, and Aquic Udipsamments in depressions
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions
- The well drained Alfic Haplorthods, sandy, which are loamy in the lower part of the subsoil and are in landscape positions similar to those of the Entic Haplorthods

Similar inclusions:
- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: None
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

225C—Entic Haplorthods, sandy, loamy substratum, rolling

Setting

Landform: Rolling areas on ground moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—grayish brown sand

Subsoil:
4 to 10 inches—dark brown, loose sand
10 to 35 inches—yellowish brown, loose sand

Substratum:
35 to 55 inches—strong brown sand
55 to 65 inches—reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, and Aquic Udipsamments in depressions
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions
- The well drained Alfic Haplorthods, sandy, which are loamy in the lower part of the subsoil and are in landscape positions similar to those of the Entic Haplorthods

Similar inclusions:
- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

225D—Entic Haplorthods, sandy, loamy substratum, hilly

Setting

Landform: Hilly areas on ground moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 4 inches—grayish brown sand

Subsoil:
4 to 10 inches—dark brown sand
10 to 35 inches—yellowish brown sand

Substratum:
35 to 55 inches—strong brown sand
55 to 65 inches—reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 70 to 90 percent
Contrasting inclusions: 10 to 30 percent

Inclusions

Contrasting inclusions:

- The well drained Alfic Haplorthods, sandy, which are loamy in the lower part of the subsoil and are in landscape positions similar to those of the Entic Haplorthods

Similar inclusions:

- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

230B—Entic Haplorthods, sandy, calcareous substratum, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 600 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand
Subsurface layer:
3 to 4 inches—light gray sand
Subsoil:
4 to 33 inches—dark brown, strong brown, and brownish yellow, loose sand
Substratum:
33 to 180 inches—light yellowish brown, very pale brown, and yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, and Aquic Udipsamments in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the substratum is fine textured
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs

Woodland ordination symbol: 4S
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

230C—Entic Haplorthods, sandy, calcareous substratum, rolling

Setting

Landform: Rolling areas on ground moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 600 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 33 inches—dark brown, strong brown, and brownish yellow, loose sand

Substratum:
33 to 180 inches—light yellowish brown, very pale brown, and yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, and Aquic Udipsamments in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the substratum is fine textured
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4S
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

230D—Entic Haplorthods, sandy, calcareous substratum, hilly

Setting

Landform: Hilly areas on ground moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 40 to 400 acres

Reference Profile

Surface layer:
0 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 33 inches—dark brown, strong brown, and brownish yellow, loose sand

Substratum:
33 to 180 inches—light yellowish brown, very pale brown, and yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The well drained Alfic Haplorthods, sandy over loamy, and the excessively drained Entic Haplorthods, sandy, loamy substratum, which are in landscape positions similar to those of the Entic Haplorthods, sandy, calcareous substratum, hilly

Similar inclusions:

- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

230E—Entic Haplorthods, sandy, calcareous substratum, steep and very steep

Setting

Landform: Steep and very steep areas on end moraines
Slope: 30 to 50 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark grayish brown sand

Subsurface layer:
2 to 4 inches—light gray sand

Subsoil:
4 to 40 inches—dark yellowish brown, loose sand
40 to 50 inches—dark brown, yellowish brown, and brownish yellow, friable sandy loam

Substratum:
50 to 99 inches—light yellowish brown and yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The well drained Alfic Haplorthods, sandy over loamy, and the excessively drained Entic Haplorthods, sandy, loamy substratum, which are in landscape positions similar to those of the Entic Haplorthods, sandy, calcareous substratum, steep and very steep

Similar inclusions:

- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Minimizing surface disturbance helps to control erosion.
- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the

trees have been logged also help to prevent excessive erosion.

- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 4R
Michigan soil management group: 5.3a
Primary plant association: Mixed oak-red maple-starflower

231B—Entic Haplorthods, sandy-Alfic Haplorthods, sandy over loamy complex, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Entic Haplorthods, sandy

Organic mat:
0 to 1 inch—partially decomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand

Substratum:
48 to 99 inches—pale brown and light yellowish brown sand

Alfic Haplorthods, sandy over loamy

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark grayish brown sand

Subsurface layer:
3 to 5 inches—grayish brown sand

Subsoil:
5 to 22 inches—dark yellowish brown and yellowish brown, loose sand
22 to 34 inches—brown, firm sandy clay loam

Substratum:
34 to 73 inches—light yellowish brown sand
73 to 91 inches—yellowish brown fine sand
91 to 99 inches—yellowish brown sandy clay loam

Soil Properties and Qualities

Permeability: Entic Haplorthods, sandy—rapid; Alfic Haplorthods, sandy over loamy—rapid in the upper part of the profile and moderately slow in the lower part
Available water capacity: Entic Haplorthods, sandy—low; Alfic Haplorthods, sandy over loamy—moderate
Drainage class: Entic Haplorthods, sandy—excessively drained; Alfic Haplorthods, sandy over loamy—well drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 40 to 70 percent
Alfic Haplorthods and similar soils: 25 to 50 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, and Medisaprists, euic, in depressions
- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes

Similar inclusions:

- Areas where the upper part of the subsoil is darker

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: Entic Haplorthods, sandy—4S; Alfic Haplorthods, sandy over loamy—5S
Michigan soil management group: Entic Haplorthods, sandy—5.3a; Alfic Haplorthods, sandy over loamy—5/2a
Primary plant association: Mixed oak-red maple-starflower
Secondary plant association: Northern red oak-red maple-mapleleaf viburnum

233B—Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Alfic Haplorthods, sandy over loamy

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 5 inches—light gray sand

Subsoil:
5 to 22 inches—dark yellowish brown and yellowish brown, loose sand
22 to 34 inches—brown, firm sandy clay loam

Substratum:
34 to 73 inches—light yellowish brown sand
73 to 91 inches—yellowish brown fine sand
91 to 99 inches—yellowish brown sandy clay loam

Entic Haplorthods, sandy

Organic mat:
0 to 1 inch—partially decomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand

Substratum:
48 to 99 inches—pale brown and light yellowish brown sand

Soil Properties and Qualities

Permeability: Alfic Haplorthods, sandy over loamy—rapid in the upper part of the profile and moderate or moderately slow in the lower part; Entic Haplorthods, sandy—rapid
Available water capacity: Alfic Haplorthods, sandy over loamy—moderate; Entic Haplorthods, sandy—low
Drainage class: Alfic Haplorthods, sandy over loamy—well drained; Entic Haplorthods, sandy—excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Alfic Haplorthods and similar soils: 40 to 75 percent
Entic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, and Medisaprists, euic, in depressions
- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes

Similar inclusions:
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: Alfic Haplorthods, sandy over loamy—5S; Entic Haplorthods, sandy—4S
Michigan soil management group: Alfic Haplorthods, sandy over loamy—5/2a; Entic Haplorthods, sandy—5.3a

Primary plant association: Northern red oak-red maple-mapleleaf viburnum
Secondary plant association: Mixed oak-red maple-starflower

233C—Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, rolling

Setting

Landform: Rolling areas on ground moraines and end moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Alfic Haplorthods, sandy over loamy

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 5 inches—light gray sand

Subsoil:
5 to 22 inches—dark yellowish brown and yellowish brown, loose sand
22 to 34 inches—brown, firm sandy clay loam

Substratum:
34 to 73 inches—light yellowish brown sand
73 to 91 inches—yellowish brown fine sand
91 to 99 inches—yellowish brown sandy clay loam

Entic Haplorthods, sandy

Organic mat:
0 to 1 inch—partially decomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand

Substratum:
48 to 99 inches—pale brown and light yellowish brown sand

Soil Properties and Qualities

Permeability: Alfic Haplorthods, sandy over loamy—rapid in the upper part of the profile and moderate or moderately slow in the lower part; Entic Haplorthods, sandy—rapid
Available water capacity: Alfic Haplorthods, sandy over loamy—moderate; Entic Haplorthods, sandy—low
Drainage class: Alfic Haplorthods, sandy over loamy—well drained; Entic Haplorthods, sandy—excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Alfic Haplorthods and similar soils: 40 to 75 percent
Entic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, and Medisaprists, euic, in depressions
- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes

Similar inclusions:
- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Alfic Haplorthods, sandy over loamy—5S; Entic Haplorthods, sandy—4S
Michigan soil management group: Alfic Haplorthods, sandy over loamy—5/2a; Entic Haplorthods, sandy—5.3a
Primary plant association: Northern red oak-red maple-mapleleaf viburnum
Secondary plant association: Mixed oak-red maple-starflower

233D—Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, hilly

Setting

Landform: Hilly areas on end moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Alfic Haplorthods, sandy over loamy

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 5 inches—light gray sand

Subsoil:
5 to 22 inches—dark yellowish brown and yellowish brown, loose sand
22 to 34 inches—brown, firm sandy clay loam

Substratum:
34 to 73 inches—light yellowish brown sand
73 to 91 inches—yellowish brown fine sand
91 to 99 inches—yellowish brown sandy clay loam

Entic Haplorthods, sandy

Organic mat:
0 to 1 inch—partially decomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand

Substratum:
48 to 99 inches—pale brown and light yellowish brown sand

Soil Properties and Qualities

Permeability: Alfic Haplorthods, sandy over loamy—rapid in the upper part of the profile and moderate or moderately slow in the lower part; Entic Haplorthods, sandy—rapid
Available water capacity: Alfic Haplorthods, sandy over loamy—moderate; Entic Haplorthods, sandy—low
Drainage class: Alfic Haplorthods, sandy over loamy—well drained; Entic Haplorthods, sandy—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Alfic Haplorthods and similar soils: 40 to 75 percent
Entic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:

- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, and Medisaprists, euic, in depressions
- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes

Similar inclusions:

- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: Alfic Haplorthods, sandy over loamy—5R; Entic Haplorthods, sandy—4R
Michigan soil management group: Alfic Haplorthods, sandy over loamy—5/2a; Entic Haplorthods, sandy—5.3a
Primary plant association: Northern red oak-red maple-mapleleaf viburnum
Secondary plant association: Mixed oak-red maple-starflower

233E—Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, steep and very steep

Setting

Landform: Steep and very steep areas on end moraines
Slope: 30 to 50 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Alfic Haplorthods, sandy over loamy

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 5 inches—light gray sand

Subsoil:
5 to 22 inches—dark yellowish brown and yellowish brown, loose sand
22 to 34 inches—brown, firm sandy clay loam

Substratum:
34 to 73 inches—light yellowish brown sand
73 to 91 inches—yellowish brown fine sand
91 to 99 inches—yellowish brown sandy clay loam

Entic Haplorthods, sandy

Organic mat:
0 to 1 inch—partially decomposed hardwood and coniferous leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 4 inches—light gray sand

Subsoil:
4 to 48 inches—dark brown, strong brown, and yellowish brown, loose sand

Substratum:
48 to 99 inches—pale brown and light yellowish brown sand

Soil Properties and Qualities

Permeability: Alfic Haplorthods, sandy over loamy—rapid in the upper part of the profile and moderate or moderately slow in the lower part; Entic Haplorthods, sandy—rapid
Available water capacity: Alfic Haplorthods, sandy over loamy—moderate; Entic Haplorthods, sandy—low
Drainage class: Alfic Haplorthods, sandy over loamy—well drained; Entic Haplorthods, sandy—excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Rapid
Flooding: None
Hazard of soil blowing: Severe

Composition

Alfic Haplorthods and similar soils: 40 to 80 percent
Entic Haplorthods and similar soils: 20 to 50 percent
Contrasting inclusions: 5 to 20 percent

Inclusions

Contrasting inclusions:

- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, and Medisaprists, euic, in depressions
- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes

Similar inclusions:

- Areas where the surface layer is loamy sand or fine sand

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because of the erosion hazard, water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid trails, and landings after the trees have been logged also help to prevent excessive erosion.
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: Alfic Haplorthods, sandy over loamy—5R; Entic Haplorthods, sandy—4R
Michigan soil management group: Alfic Haplorthods, sandy over loamy—5/2a; Entic Haplorthods, sandy—5.3a
Primary plant association: Northern red oak-red maple-mapleleaf viburnum

Secondary plant association: Mixed oak-red maple-starflower

235B—Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Alfic Haplorthods, sandy over loamy

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 5 inches—light gray sand

Subsoil:
5 to 22 inches—dark yellowish brown and yellowish brown, loose sand
22 to 34 inches—brown, firm sandy clay loam

Substratum:
34 to 73 inches—light yellowish brown sand
73 to 91 inches—yellowish brown fine sand
91 to 99 inches—yellowish brown sandy clay loam

Alfic Haplorthods, sandy

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark grayish brown loamy sand

Subsurface layer:
4 to 6 inches—light gray sand

Subsoil:
6 to 42 inches—dark yellowish brown, yellowish brown, and brownish yellow, loose sand
42 to 52 inches—dark brown, friable sandy loam

Substratum:
52 to 84 inches—light yellowish brown sand
84 to 92 inches—yellowish brown loamy sand
92 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Alfic Haplorthods, sandy over loamy—rapid in the upper part of the profile and moderate or moderately slow in the lower part; Alfic Haplorthods, sandy—rapid
Available water capacity: Moderate
Drainage class: Alfic Haplorthods, sandy over loamy—well drained; Alfic Haplorthods, sandy—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Alfic Haplorthods, sandy over loamy, and similar soils: 40 to 70 percent
Alfic Haplorthods, sandy, and similar soils: 25 to 50 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, and Medisaprists, euic, in depressions
- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes

Similar inclusions:
- Areas of soils that are weakly developed in the upper part of the subsoil and do not have a loamy texture

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: Alfic Haplorthods, sandy over loamy—5S; Alfic Haplorthods, sandy—3S
Michigan soil management group: Alfic Haplorthods, sandy over loamy—5/2a; Alfic Haplorthods, sandy—5.3a
Primary plant association: Northern red oak-red maple-mapleleaf viburnum

235C—Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, rolling

Setting

Landform: Rolling areas on ground moraines

Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Alfic Haplorthods, sandy over loamy

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 5 inches—light gray sand

Subsoil:
5 to 22 inches—dark yellowish brown and yellowish brown, loose sand
22 to 34 inches—brown, firm sandy clay loam

Substratum:
34 to 73 inches—light yellowish brown sand
73 to 91 inches—yellowish brown fine sand
91 to 99 inches—yellowish brown sandy clay loam

Alfic Haplorthods, sandy

Organic mat:
0 to 2 inches—partially decomposed hardwood leaf litter

Surface layer:
2 to 4 inches—very dark grayish brown loamy sand

Subsurface layer:
4 to 6 inches—light gray sand

Subsoil:
6 to 42 inches—dark yellowish brown, yellowish brown, and brownish yellow, loose sand
42 to 52 inches—dark brown, friable sandy loam

Substratum:
52 to 84 inches—light yellowish brown sand
84 to 92 inches—yellowish brown loamy sand
92 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Alfic Haplorthods, sandy over loamy—rapid in the upper part of the profile and moderate or moderately slow in the lower part; Alfic Haplorthods, sandy—rapid
Available water capacity: Moderate
Drainage class: Alfic Haplorthods, sandy over loamy—well drained; Alfic Haplorthods, sandy—excessively drained
Seasonal high water table: At a depth of more than 60 inches
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Alfic Haplorthods, sandy over loamy, and similar soils: 40 to 70 percent
Alfic Haplorthods, sandy, and similar soils: 25 to 50 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, and Medisaprists, euic, in depressions
- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes

Similar inclusions:
- Areas of soils that are weakly developed in the upper part of the subsoil and do not have a loamy texture

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Alfic Haplorthods, sandy over loamy—5S; Alfic Haplorthods, sandy—3S
Michigan soil management group: Alfic Haplorthods, sandy over loamy—5/2a; Alfic Haplorthods, sandy—5.3a
Primary plant association: Northern red oak-red maple-mapleleaf viburnum

240C—Entic Haplorthods, sandy, dark subsoil, rolling

Setting

Landform: Rolling areas on ground moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 2 inches—grayish brown sand

Subsoil:
2 to 4 inches—dark brown, loose sand
4 to 15 inches—brown, loose sand
15 to 30 inches—strong brown, loose sand

Substratum:
30 to 99 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, and Aquic Udipsamments in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the substratum is fine textured
- Areas where the surface layer is loamy sand or fine sand
- Areas where the subsoil is lighter colored

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 3S
Michigan soil management group: 5a
Primary plant association: Sugar maple-American beech-clubmoss

241B—Entic Haplorthods, sandy, dark subsoil, banded substratum, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Reference Profile

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 5 inches—light gray sand

Subsoil:
5 to 7 inches—dark brown, loose sand
7 to 47 inches—strong brown and yellowish brown, loose sand

Substratum:
47 to 55 inches—brownish yellow sand
55 to 99 inches—light yellowish brown sand that has lamellae of strong brown sandy loam

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 80 to 90 percent
Contrasting inclusions: 10 to 20 percent

Inclusions

Contrasting inclusions:

- The somewhat poorly drained Aeric Haplaquods, sandy, ortstein, and Aquic Udipsamments in drainageways and on foot slopes
- The poorly drained Mollic Psammaquents and very poorly drained Typic Haplaquods, sandy, and Medisaprists, euic, in depressions

Similar inclusions:

- Areas where bright mottles are in the lower part of the subsoil and in the substratum
- Areas where the substratum is fine textured
- Areas where the surface layer is loamy sand or fine sand
- Areas where the subsoil is lighter colored

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 3S
Michigan soil management group: 5a
Primary plant association: Sugar maple-American beech-clubmoss

245B—Entic Haplorthods, sandy, dark subsoil, loamy substratum, nearly level and undulating

Setting

Landform: Nearly level and undulating areas on ground moraines
Slope: 0 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 400 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 3 inches—brown sand

Subsoil:
3 to 10 inches—dark brown, loose sand
10 to 30 inches—strong brown, loose sand
30 to 40 inches—light yellowish brown, loose sand

Substratum:
40 to 45 inches—yellowish brown loamy sand
45 to 60 inches—yellowish red sandy clay loam

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:

- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, and Medisaprists, euic, in depressions
- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes

Similar inclusions:

- Areas where the subsoil is lighter colored
- Areas of soils that have a lighter colored subsoil and do not have a loamy texture
- Areas of soils that are finer textured in the surface layer, subsurface layer, and subsoil

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality

Management measures:

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: 3S
Michigan soil management group: 5/2a
Primary plant association: Sugar maple-American beech-clubmoss

245C—Entic Haplorthods, sandy, dark subsoil, loamy substratum, rolling

Setting

Landform: Rolling areas on ground moraines and end moraines
Slope: 6 to 18 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 3 inches—brown sand

Subsoil:
3 to 10 inches—dark brown, loose sand
10 to 30 inches—strong brown, loose sand
30 to 40 inches—light yellowish brown, loose sand

Substratum:
40 to 45 inches—yellowish brown loamy sand
45 to 60 inches—yellowish red sandy clay loam

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, and Medisaprists, euic, in depressions
- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes

Similar inclusions:
- Areas where the subsoil is lighter colored
- Areas of soils that have a lighter colored subsoil and do not have a loamy texture
- Areas of soils that are finer textured in the surface layer, subsurface layer, and subsoil

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation; seedling mortality, especially on southern exposures

Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: 3S
Michigan soil management group: 5/2a
Primary plant association: Sugar maple-American beech-clubmoss

245D—Entic Haplorthods, sandy, dark subsoil, loamy substratum, hilly

Setting

Landform: Hilly areas on end moraines
Slope: 18 to 30 percent
Shape of areas: Irregular
Size of areas: 10 to 150 acres

Reference Profile

Surface layer:
0 to 2 inches—very dark gray sand

Subsurface layer:
2 to 3 inches—brown sand

Subsoil:
3 to 10 inches—dark brown, loose sand
10 to 30 inches—strong brown, loose sand
30 to 40 inches—light yellowish brown, loose sand

Substratum:
40 to 45 inches—yellowish brown loamy sand
45 to 60 inches—yellowish red sandy clay loam

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 15 feet
Surface runoff: Medium
Flooding: None
Hazard of soil blowing: Severe

Composition

Entic Haplorthods and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
- The poorly drained Mollic Psammaquents and very poorly drained Medisaprists, dysic, and Medisaprists, euic, in depressions
- The somewhat poorly drained Aquic Udipsamments in drainageways and on foot slopes

Similar inclusions:
- Areas where the subsoil is lighter colored
- Areas of soils that have a lighter colored subsoil and do not have a loamy texture
- Areas of soils that are finer textured in the surface layer, subsurface layer, and subsoil

Use and Management

Land use: Woodland

Major management concerns: Erosion hazard and equipment limitation; seedling mortality, especially on southern exposures

Management measures:

- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because of the erosion hazard, logging roads and skid trails should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting seedlings that can withstand droughty conditions lowers the seedling mortality rate. Replanting is needed in some areas.

Interpretive Groups

Land capability classification: VIIs
Woodland ordination symbol: 3R
Michigan soil management group: 5/2a
Primary plant association: Sugar maple-American beech-clubmoss

250—Mollic Psammaquents-Aquic Udipsamments-Medisaprists, euic complex, occasionally flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Reference Profile

Mollic Psammaquents

Surface layer:
0 to 3 inches—black muck

Subsurface layer:
3 to 8 inches—black sandy loam

Subsoil
8 to 20 inches—light brownish gray, mottled, loose sand

Substratum:
20 to 60 inches—pale brown and light brownish gray sand

Aquic Udipsamments

Organic mat:
0 to 1 inch—partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark gray sand

Subsurface layer:
3 to 7 inches—brown sand

Subsoil:
7 to 23 inches—dark yellowish brown, friable sand
23 to 41 inches—yellowish brown, mottled, friable sand

Substratum:
41 to 60 inches—yellowish brown sand

Medisaprists, euic

16 to more than 51 inches of well decomposed organic material, which is underlain by loamy or sandy material

Soil Properties and Qualities

Permeability: Mollic Psammaquents—moderately rapid; Aquic Udipsamments—rapid; Medisaprists, euic—moderately slow to moderately rapid
Available water capacity: Mollic Psammaquents and Aquic Udipsamments—low; Medisaprists—high
Drainage class: Mollic Psammaquents—poorly drained; Aquic Udipsamments—moderately well drained; Medisaprists—very poorly drained
Seasonal high water table: Mollic Psammaquents—1.0 foot above to 1.0 foot below the surface from November through May; Aquic Udipsamments—1.5 to 3.5 feet below the surface from November through April; Medisaprists, euic—1.0 foot above to 1.0 foot below the surface from September through June
Surface runoff: Very slow
Flooding: Occasional
Hazard of soil blowing: Slight

Composition

Mollic Psammaquents and similar soils: 40 to 55 percent
Aquic Udipsamments and similar soils: 30 to 50 percent
Medisaprists and similar soils: 5 to 20 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:

- The very poorly drained Medisaprists, dysic, in landscape positions similar to those of the Medisaprists, euic
- The excessively drained Entic Haplorthods, sandy, in the higher landscape positions

Similar inclusions:

- Areas where the substratum is fine textured

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard,

Management measures:
- The seasonal high water table restricts the use of equipment to midsummer, when the soils are dry, or midwinter, when the soils are frozen.
- Skidders should not be used during wet periods.
- Because of wetness and seedling mortality, trees generally are not planted on these soils.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: Mollic Psammaquents and Medisaprists—none; Aquic Udipsamments—4S
Michigan soil management group: Mollic Psammaquents—5c; Aquic Udipsamments—5b; Medisaprists—Mc
Primary plant association: Mollic Psammaquents and Aquic Udipsamments—Red maple-balsam fir-bunchberry dogwood; Medisaprists—Northern whitecedar-eastern hemlock-Canada violet

262A—Aeric Haplaquods, sandy, ortstein, nearly level

Setting

Landform: Nearly level areas on outwash plains
Slope: 0 to 4 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Organic mat:
0 to 1 inch—black, partially decomposed forest litter
Surface layer:
1 to 5 inches—very dark grayish brown sand
Subsurface layer:
5 to 11 inches—pinkish gray, mottled sand
Subsoil:
11 to 17 inches—dark reddish brown, mottled, weakly cemented sand
17 to 31 inches—dark brown and brown, mottled, loose sand
Substratum:
31 to 60 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Moderate in the cemented layer and rapid in the rest of the profile
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: 0.5 foot to 2.5 feet below the surface from October through June
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Slight

Composition

Aeric Haplaquods and similar soils: 80 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Entic Haplorthods, sandy, in the higher landscape positions
- The very poorly drained Medisaprists, dysic, in depressions

Similar inclusions:
- Areas where the substratum is fine textured
- Areas of soils that have a thin surface layer of organic material
- Areas of soils that are not weakly cemented in the upper part of the subsoil

Use and Management

Land use: Woodland
Major management concerns: Equipment limitation, seedling mortality, windthrow hazard
Management measures:
- The seasonal high water table restricts the use of equipment to midsummer, when the soils are dry, or midwinter, when the soils are frozen. Skidders should not be used during wet periods.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 4W
Michigan soil management group: 5b-h
Primary plant association: Northern red oak-red maple-leatherleaf-blueberry

263A—Aquic Udipsamments, nearly level

Setting

Landform: Nearly level areas on outwash plains
Slope: 0 to 4 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Reference Profile

Organic mat:
0 to 1 inch—black, partially decomposed hardwood leaf litter

Surface layer:
1 to 3 inches—very dark gray sand
Subsurface layer:
3 to 7 inches—pale brown sand
Subsoil:
7 to 23 inches—dark yellowish brown, friable sand
23 to 41 inches—yellowish brown, mottled, friable sand
Substratum:
41 to 60 inches—yellowish brown, mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: 1.5 to 3.5 feet below the surface from November through May
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Severe

Composition

Aquic Udipsamments and similar soils: 80 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Entic Haplorthods, sandy, in the higher landscape positions
- The very poorly drained Medisaprists, dysic, in depressions

Similar inclusions:
- Areas where the substratum is fine textured
- Areas of soils that have a thin surface layer of organic material
- Areas of soils that are weakly cemented in the upper part of the subsoil

Use and Management

Land use: Woodland
Major management concerns: Equipment limitation, seedling mortality
Management measures:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soils are moist can reduce the seedling mortality rate.
- Trees that can withstand seasonal wetness should be selected for planting.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: None
Michigan soil management group: 5.3a
Primary plant association: Red maple-balsam fir-bunchberry dogwood

272—Typic Haplaquods, sandy

Setting

Landform: Depressions on outwash plains and lake plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 300 acres

Reference Profile

Surface layer:
0 to 6 inches—black mucky sand
Subsurface layer:
6 to 9 inches—grayish brown, mottled sand
Subsoil:
9 to 12 inches—dark reddish brown, friable sand
12 to 25 inches—dark brown, friable sand
Substratum:
25 to 60 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from November through May
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Slight

Composition

Typic Haplaquods and similar soils: 80 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Entic Haplorthods, sandy, in the higher landscape positions
- The very poorly drained Medisaprists, dysic, in depressions

Similar inclusions:
- Areas where the substratum is fine textured
- Areas of soils that have a thin surface layer of organic material
- Areas where the surface layer is finer textured
- Areas of soils that are weakly cemented in the upper part of the subsoil

Use and Management

Land use: Woodland
Major management concerns: Equipment limitation,

windthrow hazard, seedling mortality, plant competition

Management measures:

- The seasonal high water table restricts the use of equipment to midsummer, when the soils are dry, or midwinter, when the soils are frozen. Skidders should not be used during wet periods.
- Because of wetness and seedling mortality, trees generally are not planted on these soils.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: VIw
Woodland ordination symbol: None
Michigan soil management group: 5b-h
Primary plant association: Northern red oak-red maple-leatherleaf-blueberry

273—Mollic Psammaquents

Setting

Landform: Depressions on outwash plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 350 acres

Reference Profile

Surface layer:
0 to 3 inches—black muck

Subsurface layer:
3 to 8 inches—black sandy loam
8 to 20 inches—light brownish gray, mottled, loose sand

Substratum:
20 to 60 inches—pale brown and light brownish gray sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from November through May
Surface runoff: Very slow
Flooding: None
Hazard of soil blowing: Slight

Composition

Mollic Psammaquents and similar soils: 80 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The very poorly drained Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where the substratum is fine textured
- Areas of soils that have a thin surface layer of organic material
- Areas where the surface layer is finer textured

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:

- The seasonal high water table restricts the use of equipment to midsummer, when the soils are dry, or midwinter, when the soils are frozen. Skidders should not be used during wet periods.
- Because of wetness, seedling mortality, and plant competition, trees generally are not planted on these soils.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: None
Michigan soil management group: 5c
Primary plant association: Red maple-balsam fir-bunchberry dogwood

274—Typic Haplaquolls, sandy over loamy

Setting

Landform: Depressions on ground moraines, lake plains, and flood plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 350 acres

Reference Profile

Surface layer:
0 to 2 inches—black muck

Subsurface layer:
2 to 10 inches—black loamy fine sand

Subsoil:
10 to 14 inches—gray, mottled, very friable loamy fine sand

Substratum:
14 to 20 inches—grayish brown, mottled loamy fine sand
20 to 44 inches—brown sandy clay loam

44 to 60 inches—grayish brown silty clay loam

Soil Properties and Qualities

Permeability: Rapid in the upper part of the profile and moderately slow in the lower part
Available water capacity: High
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from November through May
Surface runoff: Very slow or ponded
Flooding: Occasional
Hazard of soil blowing: None

Composition

Typic Haplaquolls and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The very poorly drained Medisaprists, dysic, in depressions

Similar inclusions:

- Areas where the surface layer is thinner and lighter colored

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard

Management measures:

- The seasonal high water table restricts the use of equipment to midsummer, when the soils are dry, or midwinter, when the soils are frozen. Skidders should not be used during wet periods.
- Because of wetness, seedling mortality, and plant competition, trees generally are not planted on these soils.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: None
Michigan soil management group: 4/2c
Primary plant association: Mixed ash-American basswood-downy yellow violet

280—Aquents and Histosols, ponded

Setting

Landform: Depressions on outwash plains and moraines
Slope: 0 to 2 percent
Shape of areas: Oval
Size of areas: 5 to 100 acres

Soil Properties and Qualities

Permeability: Variable
Available water capacity: Variable
Drainage class: Very poorly drained
Seasonal high water table: Aquents—1 foot above to 1 foot below the surface throughout the year; Histosols—1 foot above to 1 foot below the surface from September through June
Surface runoff: Ponded
Flooding: None
Hazard of soil blowing: None

Composition

Aquents and Histosols: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:

- Small areas of somewhat poorly drained soils at the edges of the unit
- Small areas of open water

Use and Management

Land use: Wetland wildlife habitat

Management measures:

- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: None
Michigan soil management group: None

281—Medisaprists, dysic

Setting

Landform: Closed depressions on outwash plains and flood plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 150 acres

Soil Properties and Qualities

Texture: 16 to more than 51 inches of muck, which is underlain by sandy material
Permeability: Moderately slow to moderately rapid in the upper part of the profile and rapid in the lower part
Available water capacity: High
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from September through June
Surface runoff: Very slow or ponded
Flooding: None
Organic matter content: High

Hazard of soil blowing: Slight

Composition

Medisaprists: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The poorly drained Mollic Psammaquents in the slightly higher landscape positions

Similar inclusions:
- Areas where the subsoil has a higher content of fiber

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, plant competition

Management measures:
- The seasonal high water table restricts the use of equipment to midsummer, when the soils are dry, or midwinter, when the soils are frozen. Skidders should not be used during wet periods.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.
- After the trees are cut, controlling the competition from brush improves the regeneration of desired species.
- Because of wetness, seedling mortality, and plant competition, trees generally are not planted on these soils.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: 2W
Michigan soil management group: M/5c
Primary plant association: Black spruce-tamarack-Labrador tea

282—Medisaprists, euic

Setting

Landform: Depressions on outwash plains and moraines
Slope: 0 to 2 percent
Shape of areas: Oval or irregular
Size of areas: 5 to 150 acres

Soil Properties and Qualities

Texture: 16 to more than 51 inches of muck, which is underlain by loamy or sandy material
Permeability: Moderately slow to moderately rapid in the upper part of the profile and variable in mineral material
Available water capacity: High
Drainage class: Very poorly drained
Seasonal high water table: 1 foot above to 1 foot below the surface from September through June
Surface runoff: Very slow or ponded
Flooding: None
Organic matter content: High
Hazard of soil blowing: Slight

Composition

Medisaprists: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The poorly drained Mollic Psammaquents in the slightly higher landscape positions

Similar inclusions:
- Areas where the subsoil has a higher content of fiber

Use and Management

Land use: Woodland

Major management concerns: Equipment limitation, seedling mortality, windthrow hazard, plant competition

Management measures:
- The seasonal high water table restricts the use of equipment to midsummer, when the soils are dry, or midwinter, when the soils are frozen. Skidders should not be used during wet periods.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.
- After the trees are cut, controlling the competition from brush improves the regeneration of desired species.
- Because of wetness, seedling mortality, and plant competition, trees generally are not planted on these soils.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: 2W
Michigan soil management group: Mc
Primary plant association: Northern whitecedar-eastern hemlock-Canada violet

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown under the heading "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops are listed.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

A total of 96,926 acres in Oceana County, or nearly 28 percent of the acreage, is farmland. This total includes 16,962 acres of permanent pasture, 12,970 acres of row crops, 14,405 acres of orchards, 24,818 acres of hay and small grain, 17,700 acres of vegetables, and 10,071 acres of Christmas trees *(10)*. The acreage used for field crops fluctuates from year to year because of anticipated market prices, weather conditions, and the wide variety of crops suited to the soils.

The most common row crops suited to the soils and climate in the county are corn, wheat, rye, and oats. Barley and soybeans are not so common but can be grown. Alfalfa, alone or in mixtures with clover and grasses, is the most common hay crop.

Many soil-related management concerns are common on a large number of different soils. The following paragraphs describe the concerns in managing the cropland and pasture in Oceana County. These concerns are water erosion, soil blowing, seasonal wetness, seasonal droughtiness, tilth in the surface layer, and soil fertility.

Water erosion and *soil blowing* are the major management concerns on most of the cropland in the county. Loss of the surface layer through erosion is especially damaging on soils that have a loamy surface layer, such as Perrinton, Claybanks, and Nappanee soils, and on soils that tend to be droughty, such as Spinks and Benona soils. Erosion on cropland results in the sedimentation and pollution of streams. Controlling erosion minimizes this pollution and improves the quality of water for municipal and recreational uses and for fish and wildlife.

Water erosion is a serious hazard on all loamy and clayey soils that have slopes of 2 percent of more. Preparing a good seedbed is difficult on some of the soils because the friable surface layer has been eroded away in places.

Erosion-control practices provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that includes small grain and forage species in the rotation for extended periods reduces the susceptibility to erosion and preserves the productive capacity of the soil. On livestock farms, where pasture and hay are needed, including forage crops of grasses and legumes in the cropping sequence helps to control erosion on the more sloping land, provides nitrogen for subsequent crops, and improves tilth. Conservation tillage helps to control runoff and erosion by leaving protective amounts of crop residue on the surface. Cover crops, diversions, and grassed waterways also help to control erosion.

Soil blowing is a hazard on loamy and sandy soils. An adequate plant cover, surface mulch, field windbreaks, buffer strips, and tillage methods that leave crop residue on the surface help to control soil blowing.

No-till farming, which is becoming more common in the county, is effective in controlling water erosion and soil blowing because it leaves crop residue on the surface. It is suited to most of the soils in the county. Because of no-till farming, eroding areas that otherwise are only marginally productive can become more productive. No-till farming helps to maintain the productive capacity of nearly all cropland. In areas where no-till crops are grown, different methods of planting and of controlling insects and weeds are needed. The proper time for planting, the selection of herbicides that are suited to the existing vegetation, an adequate supply of plant nutrients, and the selection of tillage systems based on soil characteristics are important management requirements.

Much of the permanent pasture in the county is in areas where erosion is a hazard. Control of erosion is particularly important when the pasture is seeded. Forage production and the extent to which the plant cover protects the surface of the soil are influenced by the number of livestock that the pasture supports, the length of time that they graze, and the distribution of rainfall. Good pasture management includes stocking rates that maintain the key forage species, pasture rotation, timely deferment of grazing, and strategic location of water supplies for livestock.

Information about the design and application of erosion-control practices on the different soils in the county is available in local offices of the Natural Resources Conservation Service.

Seasonal wetness is a major management concern in many areas used for crops and pasture. Draining cropland improves the air-water relationship in the root zone. In areas where drainage is poor, spring planting, spraying, and harvesting are delayed and controlling weeds is difficult. Properly designed subsurface drainage systems or surface drainage systems, or both, can be used to remove excess water.

Unless drained, some soils are naturally so wet that they cannot be used for the crops commonly grown in the county. Unless drained, the very poorly drained, poorly drained, and somewhat poorly drained soils are so wet that crops are damaged in most years. Bono, Ithaca, Granby, Nappanee, and Hoytville soils are examples of poorly drained or somewhat poorly drained soils. Natural drainage is good in Claybanks, Perrinton, and Remus soils most of the year, but these soils tend to dry slowly after rains. Small areas of wetter soils along drainageways and in swales are commonly included in some areas of these soils, especially where slopes are 1 to 6 percent. A drainage system is needed in some of these wetter areas.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and subsurface drainage is needed in most areas of poorly drained soils that are intensively row cropped. The drains should be more closely spaced in slowly permeable or very slowly permeable soils than in the more rapidly permeable soils. Adequate outlets for subsurface drainage systems are not readily available in many areas of Granby, Bono, and Hoytville soils. Diversions can be used to remove surface runoff from some wet areas. Good soil tilth and an ample supply of organic matter also improve drainage.

Drainage of some designated wetlands is a violation of wetland laws and regulations. Information about these areas and about the design of drainage systems for each kind of soil is available in the local office of the Natural Resources Conservation Service.

Droughtiness during dry periods is a concern in managing Benona, Spinks, Grattan, Fern, Pipestone, and Arkona soils. Moisture can be conserved by no-till farming and other kinds of conservation tillage, which leave all or part of the crop residue on the surface. Increasing the organic matter content improves the available water capacity, and irrigation improves productivity. The droughty soils and many other soils in the county are suited to irrigation if they are properly managed.

Soil tilth affects the germination of seeds and the infiltration of water into the soil. Some of the soils used for crops have a loamy surface layer. Generally, the structure of such soils is weak. A crust forms on the surface during periods of intensive rainfall. The crust hinders the emergence of plant seedlings, decreases the rate of water infiltration, and increases the runoff rate. Regular additions of crop residue, manure, and other organic material improve tilth and help to prevent surface crusting.

Maintaining good tilth is difficult in loamy or clayey soils, such as Nappanee, Hoytville, Bono, and Ithaca soils, because these soils stay wet until late in spring. If the soils are plowed when wet, they tend to be very cloddy when dry and are compacted. As a result, preparing a good seedbed is difficult.

Cover crops, green manure crops, proper management of crop residue, conservation tillage, and applications of livestock manure help to maintain or improve tilth and increase the organic matter content. Fall plowing and chisel plowing when the soils are at the proper moisture content can help to prevent deterioration of tilth in nearly level, poorly drained or somewhat poorly drained soils. These practices also allow the soils to be tilled earlier during the following spring. Fall plowing is not suitable, however, on sloping soils or on soils that are subject to soil blowing.

Grazing by livestock when loamy or clayey soils are wet results in compaction and poor tilth and thus retards the growth of pasture plants. Proper harvesting methods, such as those for hay or silage, help to prevent compaction and improve plant growth.

Soil fertility is naturally medium or high in loamy soils and low in most sandy soils on uplands. Many sandy soils naturally range from strongly acid to slightly acid. If lime has never been applied on these soils, applications of ground limestone are needed to raise the pH level sufficiently for the production of alfalfa and other crops that grow well only on nearly neutral soils. Available phosphorus and potash levels are naturally low or medium in most of the sandy soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields *(12)*.

Specialty Crops

Oceana County has the variety of soils, topography, and climatic conditions suitable for the production of a wide variety of vegetable and fruit crops. The county is the top producer of asparagus and pears in the State. Other common vegetable crops are green beans, squash, sweet corn, cucumbers, peppers, cauliflower, broccoli, and carrots.

Certain parts of the county, mainly the western part, are especially well suited to fruit trees. The main fruit crops are apples (fig. 7), tart cherries, sweet cherries, peaches, pears, plums, and nectarines. Some sites are better suited to these crops than others, mainly because of variations in elevation and air drainage. The proximity of an area to Lake Michigan and its moderating effects on air temperature also affect the suitability for fruit crops.

Soil properties affect management practices, tree growth, and productivity in orchards. Local climatic conditions affect fruit-set, pollination by bees, the number of blossoms per tree, and frost damage to woody parts of the trees.

The latest information about growing specialty crops in the county can be obtained from local offices of the Cooperative Extension Service and the Natural Resources Conservation Service.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared

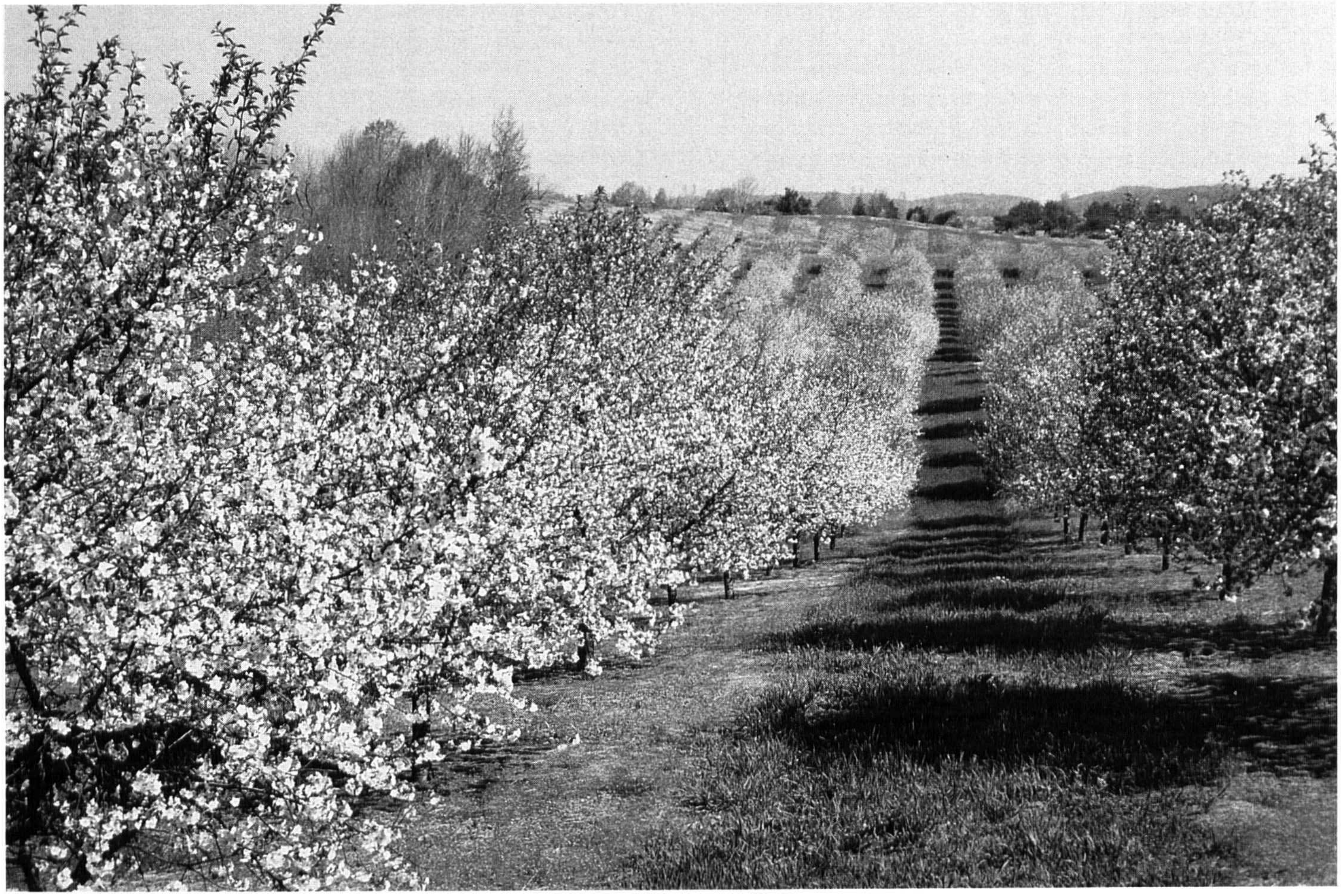

Figure 7.—An apple orchard in an area of Spinks loamy fine sand, 6 to 12 percent slopes.

with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(18)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the section "Interpretive Groups," which follows the tables at the back of this survey.

At the end of each map unit description under the heading "Detailed Soil Map Units," the Michigan soil management group is listed. The soils in each map unit are assigned to a group according to the dominant texture, the drainage class, and the major management concerns *(11).*

Woodland Management and Productivity

Ken Brummel and Pete McCurdy, foresters, Oceana County Soil Conservation District, helped prepare this section.

All of Oceana County was originally covered with climax forests of white pine, hemlock, and hardwoods. The entire area was harvested, and the slash was burned. The current woodland is regrowth that reflects various management practices.

A total of 150,245 acres in the county, or 43 percent of the acreage, is woodland. National and State forests make up about 57,500 acres of that total.

The composition of the forest, by cover type, is 31 percent oak, 18 percent upland hardwoods, 18.5 percent aspen-birch, 12 percent lowland hardwoods, 9 percent red pine, 3 percent Scotch pine, 3.5 percent lowland conifers, 2 percent mixed pines, 1 percent jack pine, and 0.5 percent white spruce. By stand size, the composition is 18 percent sawtimber, 63 percent poletimber, 16 percent saplings, and 3 percent nonstocked areas.

Six major kinds of forest cover types are in the county *(16).* Each has different value and potential for woodland production. The soils of an area are a key determinant for forest species composition, and the general soil map at the back of this publication can be used to locate forest cover types.

White pine cover is in areas of the Plainfield-Coloma-Grattan association on the general soil map. Other common associated trees are red maple, red pine, white oak, black oak, and red oak. A calcareous, subirrigated, or loamy substratum at a depth of more than 60 inches in those areas may produce a cover type of sugar maple and American beech.

Sugar maple cover is in areas of the Benona-Spinks-Grattan association. Other common associated trees are eastern hemlock, white oak, red maple, northern red oak, white pine, and cherry.

Sugar maple-beech-yellow birch cover is in areas of the Spinks-Remus-Fern and Perrinton-Gowdy-Ithaca associations. Other common associated trees are white oak, white ash, northern red oak, American basswood, eastern hemlock, cherry, and red maple.

Black ash-American elm-red maple cover is in areas of the Houghton-Kerston-Carlisle and the Medisaprists, euic-Typic Haplaquolls, sandy over loamy-Mollic Psammaquents associations. Other common associated trees are northern whitecedar, aspen, and birch.

White pine-eastern hemlock cover is in areas of the Epworth-Dune land-Nordhouse association. Other common associated trees are red pine, white oak, red maple, and quaking aspen.

White pine-northern red oak-white ash cover is in areas of the Grattan-Covert-Granby association. Other common associated trees are white oak, eastern hemlock, birch, northern whitecedar, and quaking aspen.

Three main methods of harvesting are used in the county. Clear cutting is used in harvesting aspen, white pine, and red pine. Selective cutting and shelterwood cutting are used in harvesting most of the hardwoods, such as black cherry, sugar maple, red oak, white oak, and American beech. Plant competition is a management concern on most soils after an area has been harvested, as is the invasion of undesirable species. Site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

The major woodland products in this county are described in the following paragraphs.

Pulpwood.—Paper products are derived from pulpwood.

Sawlogs.—Furniture, lumber, crates, and baskets are produced from sawlogs. There are four major saw mills and seven small custom mills in the county. Red pine yields logs, landscape ties, and utility poles. High-quality sawlogs can be produced if stands are properly thinned.

Firewood.—Some kinds of local trees are better than others for fuel. Oak, beech, sugar maple, and birch have high heat value. Red maple, cherry, and American elm have intermediate heat value. Aspen, American basswood, and evergreens have low heat value but tend to ignite easily and burn quickly. Cutting for firewood can improve the timber stand if undesirable trees are removed.

Christmas trees.—Scotch pine and Douglas-fir are grown on sandy soils. Spruce and a few balsam fir are grown on loamy soils. The trees are harvested at an age of 6 to 12 years.

Maple syrup.—Several small enterprises in the county produce maple syrup from mature sugar maple stands.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year at the age of culmination of mean annual increment, indicates the amount of fiber produced in a fully stocked, even-age, unmanaged stand. The volume was determined through the use of standard yield tables *(23)*.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Plant Associations

The Huron-Manistee National Forest Ecological Classification System (ECS) was developed to meet the information needs of the National Forest System *(3)*. These needs are met by delineating land units for planning analyses, predicting vegetative structure and the distribution of wildlife habitat, planning desired future conditions within and across geologic regions for conservation of biological diversity, and evaluating ecological processes, such as forest succession or soil productivity. The overall purpose of the ECS is to provide an ecological framework for integrated resource planning and management.

The ECS is an ecological approach to defining the biological potential of the National Forest land base. Multiple ecological factors were used to define and classify the map units. Information on climate, landforms, soils, and vegetation was integrated before the map units were described and delineated. The information on vegetation and soils was used mainly to delineate map units in the field.

Plant associations are used in the mapping process to help identify map units. The associations are combinations of late successional overstories and groups of associated understory and ground flora species. Species groups are associated with the map unit. Species composition may vary, however, within the map units, and any given species may be absent from a species group at a particular site. In some instances the plant association does not reflect soil characteristics and potential. In areas that have no diagnostic plant communities because of natural variability or disturbance, soil and landform variables alone serve as differentiating map unit criteria.

Plant associations have been determined for the map units in the National Forest part of the survey area. The primary plant association, specified at the end of the description of these map units in the section "Detailed Soil Map Units," is the most diagnostic association for the landforms and soils of the map unit.

The following paragraphs describe the plant associations in the survey area. The paragraphs specify the landform and soil type for each association, the potential late successional overstory and diagnostic understory, and the ground flora species characteristic of the association.

Black oak (*Quercus velutina*)-white oak (*Quercus alba*)-blueberry (*Vaccinium angustifolium*).—This plant association is characteristic of dry, nutrient-poor areas of sandy soils. The potential late successional natural vegetation includes species that have adapted to harsh conditions and frequent fires. This vegetation is represented by overstory species of black oak (*Quercus velutina*), white oak (*Quercus alba*), and northern pin oak (*Quercus ellipsoidalis*). The main distinguishing ground flora and understory species are blueberry (*Vaccinium angustifolium*), cowwheat (*Melampyrum*), trailing arbutus (*Epigaea repens*), huckleberry (*Gaylussacia baccata*), brackenfern (*Pteridium aquilinum*), red maple (*Acer rubrum*) seedlings, and oak (*Quercus spp.*) seedlings.

Mixed oak (*Quercus spp.*)-red maple (*Acer rubrum*)-starflower (*Trientalis borealis*).—This plant association is primarily on sandy soils that exhibit weak spodic development. The common potential late successional overstory species are black oak (*Quercus velutina*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), red maple (*Acer rubrum*), red pine (*Pinus resinosa*), and eastern white pine (*Pinus strobus*). The main distinguishing ground flora and understory species are mapleleaf viburnum (*Viburnum acerifolium*), brackenfern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), starflower (*Trientalis borealis*), blueberry (*Vaccinium angustifolium*), red maple (*Acer rubrum*) seedlings and saplings, and juneberry (*Amelanchier spp.*).

Northern red oak (*Quercus rubra*)-red maple (*Acer rubrum*)-mapleleaf viburnum (*Viburnum acerifolium*).—This plant association is primarily in sandy morainal areas and in areas of well developed soils on lake plains. The common potential late successional overstory species are northern red oak (*Quercus rubra*), red maple (*Acer rubrum*), and eastern white pine (*Pinus strobus*). The main distinguishing ground flora and understory species are mapleleaf viburnum (*Viburnum acerifolium*), wild sarsaparilla (*Aralia nudicaulis*), wild lily of the valley (*Maianthemum canadense*), bigleaf aster (*Aster macrophyllus*), squawroot (*Conopholis americana*), red maple (*Acer rubrum*) seedlings and saplings, and witchhazel (*Hammamelis virginiana*).

Sugar maple (*Acer saccharum*)-American beech (*Fagus grandifolia*)-clubmoss (*Lycopodium obscurum and L. lucidulum*).—This plant association is in areas on sandy moraines and sandy lake plains where the subsoil is dark. The common potential late successional overstory species are sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), northern red oak (*Quercus rubra*), and red maple (*Acer rubrum*). The association is characterized by low diversity and coverage of flora along the forest floor. The main distinguishing understory and ground flora species are wild lily of the valley (*Maianthemum canadense*), clubmoss (*Lycopodium obscurum and L. lucidulum*), true Solomons seal (*Polygonatum biflorum*), sedge (*Carex pedunculata*), and sugar maple (*Acer saccharum*) seedlings.

Northern red oak (*Quercus rubra*)-red maple (*Acer rubrum*)-leatherleaf (*Chamaedaphne calyculata*)-blueberry (*Vaccinium angustifolium*).—This plant association is in areas of poorly drained, acidic sand on outwash plains and lake plains. The common potential late successional overstory species are northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), white oak (*Quercus alba*), red maple (*Acer rubrum*), and eastern white pine (*Pinus strobus*). The characteristic species are suited to soils that are acidic and frequently anaerobic. The main distinguishing understory and ground flora species are leatherleaf (*Chamaedaphne calyculata*), blueberry (*Vaccinium angustifolium*), Labrador tea (*Ledum groenlandicum*), wintergreen (*Gaultheria procumbens*), dewberry (*Rubus spp.*), brackenfern (*Pteridium aquilinum*), and speckled alder (*Alnus rugosa*).

Red maple (*Acer rubrum*)-balsam fir (*Abies balsemea*)-bunchberry dogwood (*Cornus canadensis*).—This plant association is in areas of slightly acid to alkaline, sandy soils on outwash plains, flood plains, and lake plains. The common potential late successional overstory species are red maple (*Acer rubrum*), black ash (*Fraxinus nigra*), green ash (*Fraxinus pennsylvanica*), balsam fir (*Abies balsemea*), and eastern white pine (*Pinus strobus*). The main distinguishing understory and ground flora species are wild lily of the valley (*Maianthemum canadense*), bunchberry dogwood (*Cornus canadensis*), goldthread (*Coptis groenlandica*), wintergreen (*Gaultheria procumbens*), and shield fern (*Dryopteris spinulosa*).

Mixed ash (*Fraxinus spp.*)-American basswood (*Tilia americana*)-downy yellow violet (*Viola pubescens*).—This plant association is on poorly drained, nutrient-rich, loamy soils and shallow, organic soils. It is on lakebeds, till plains, and flood plains. The common potential late successional overstory species are American basswood (*Tilia americana*), eastern hemlock (*Tsuga canadensis*), black ash (*Fraxinus nigra*), green ash (*Fraxinus pennsylvanica*), and northern whitecedar (*Thuja occidentalis*). The main distinguishing understory and ground flora species are downy yellow violet (*Viola pubescens*), maidenhair fern (*Adiantum pedatum*), cinnamon fern (*Osmunda cinnamomea*), Jack in the pulpit (*Arisamea triphyllum*), and bellwort (*Uvularia perfoliata*).

Black spruce (*Picea mariana*)-tamarack (*Larix laricina*)-Labrador tea (*Ledum groenlandicum*).—This plant association is on poorly drained, deep, dysic, organic soils in acidic bogs on outwash plains and lake plains. The overstory is sparse. Black spruce (*Picea mariana*) and tamarack (*Larix laricina*) are the dominant species. The main distinguishing understory and ground flora species are Labrador tea (*Ledum groenlandicum*), leatherleaf (*Chamaedaphne calyculata*), sphagnum species, and speckled alder (*Alnus rugosa*).

Northern whitecedar (*Thuja occidentalis*)-eastern hemlock (*Tsuga canadensis*)-Canada violet (*Viola canadensis*).—This plant association is on poorly drained, deep, euic, organic soils on flood plains, till plains, and lakebeds. The common potential late successional overstory species are northern whitecedar (*Thuja occidentalis*), eastern hemlock (*Tsuga canadensis*), white spruce (*Picea glauca*), and black ash (*Fraxinus nigra*). The main distinguishing understory and ground flora species are Canada violet (*Viola canadensis*), maidenhair fern (*Adiantum pedatum*), bedstraw (*Galium spp.*), and wild lily of the valley (*Maianthemum canadense*).

Windbreaks and Environmental Plantings

Philip Dakin, state forester, Natural Resources Conservation Service, helped prepare this section.

Over half of all the erosion damage in Oceana County is caused by the wind. Soil blowing is especially severe if row crops are grown in areas of sandy soils. Individual windstorms in the county during April and May often each erode as much as 15 tons of soil from such areas. Additionally, such crops as snap beans and asparagus are severely "sand blasted" by the windblown soil.

A windbreak of trees and shrubs is one of the conservation measures used to control soil blowing. Other conservation measures, such as annual and perennial vegetative barriers, stripcropping, crop residue management, and cover crops, can be used with the windbreaks to provide a complete system of protection against soil blowing.

A windbreak shelters a downwind area equal to about 10 times the height of the windbreak. The sheltering effect reduces soil loss, the extent of crop damage, the evapotranspiration rate, livestock exposure, farmstead damage, and home heating costs and keeps snow on the fields. In addition, the windbreak provides shelter, food, and nesting areas for wildlife.

Windbreaks have esthetic value; help to screen houses, buildings, and livestock enterprises; control odors on sites for the livestock enterprises; abate noise from farming activities, highways, and industrial areas; and increase the value of land.

A planted windbreak consists of broadleaf and coniferous trees or shrubs, the spacing and number of which depend on the purpose of the windbreak. Each windbreak is designed for the specific site conditions, resource problems, and landowner objectives. To ensure plant survival and a viable windbreak, a healthy stock of suitable species should be planted properly on a well prepared site and maintained through weed control, protection against animals, and replacement of dead or damaged plants.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on suitable soils in the county. The estimates in table 9 are based on measurements and observations of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks. Additional information on planning windbreaks and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service.

Recreation

Numerous opportunities for recreation are available in Oceana County. The county has about 150,000 acres of forest land, 65 inland lakes, and 27 miles of shoreline along Lake Michigan. About 48,000 acres of Federal land and 1,700 acres of State land are suitable for fishing, hunting, boating, camping, picnicking, hiking, swimming, snowmobiling, and cross-country skiing. A 22-mile bike trail extends from Hart to Montague. The main public lands available for recreational uses are the Pentwater River State Game Area, Silver Lake State Park, Charles Mears State Park, and 12 county parks.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones, is firm after rains, and is not dusty when dry.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones on the surface.

Wildlife Habitat

The habitat for wildlife in Oceana County is diverse. It includes heavily wooded areas, open farmland, and many streams, inland lakes, and wetlands that support diverse populations of fish and wildlife.

The streams and lakes in the county provide habitat for large populations of sunfish, perch, largemouth bass, smallmouth bass, northern pike, and bullheads. The rivers and streams are popular among fishermen for their trout, salmon, and steelhead.

The plant and animal communities in the county include many species recognized by the State of Michigan as rare, threatened, or endangered. These species include the common loon, prairiesmoke, pitcher's thistle, and clustered broomrape.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are buckwheat, corn, wheat, millet, oats, and rye.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are orchardgrass, red clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are goldenrod, aster, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, aspen, cherry, apple, hawthorn, and autumn-olive.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, and cedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cattail, rushes, and sedges.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include pheasant, meadowlark, field sparrow, cottontail, and coyote.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodpeckers, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are wading birds, muskrat, and mink.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by depth to a cemented pan or a very firm, dense layer; soil texture; and slope. The time of the year that excavations can be made is affected by depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to a cemented pan, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to a cemented pan, a high water table, flooding, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to a cemented pan, and flooding affect absorption of the effluent. A cemented pan can interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel are less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to a cemented pan, flooding, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and cemented pans can cause construction problems.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over a cemented pan or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration.

The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on depth to a cemented pan or to other layers that affect the rate of water movement, permeability, depth to a high water table or depth of standing water if the soil is subject to ponding, slope, susceptibility to flooding, subsidence of organic layers, and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

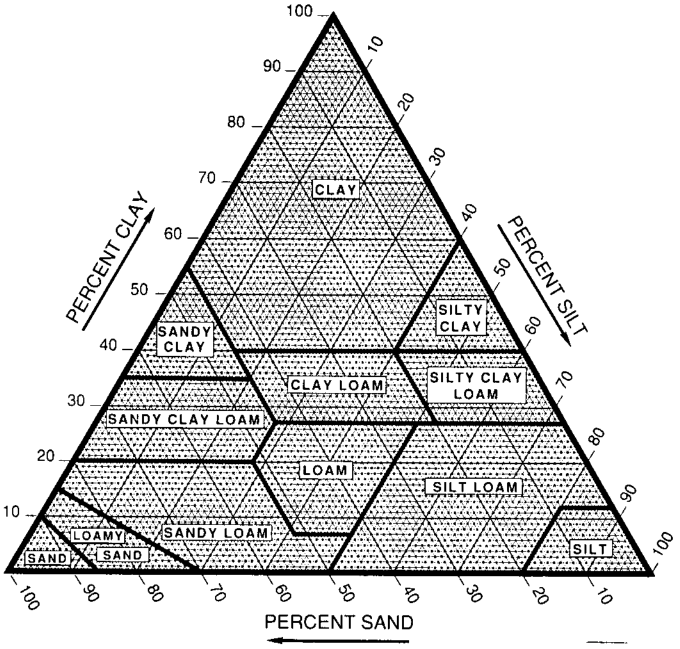

Figure 8.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 8). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 18 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(19)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Spodosol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquod (*Aqu*, meaning water, plus *od*, from Spodosol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquods (*Hapl*, meaning minimal horizonation, plus *aquod*, the suborder of the Spodosols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Entic Haplaquods.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy, mixed, mesic Entic Haplaquods.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(22)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(19)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Adrian Series

The Adrian series consists of very poorly drained soils in depressions on ground moraines and outwash plains. These soils formed in 16 to 51 inches of mucky deposits that are underlain by sandy glacial drift. Permeability is moderately slow to moderately rapid in the upper part of the profile and rapid in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Adrian muck, 2,100 feet west and 50 feet south of the northeast corner of sec. 35, T. 15 N., R. 16 W., Elbridge Township:

Oa1—0 to 12 inches; muck, black (N 2/0) broken face and rubbed; about 5 percent fiber, less than 1 percent rubbed; weak medium granular structure; friable; common fine and medium roots; neutral; clear wavy boundary.

Oa2—12 to 18 inches; muck, black (N 2/0) broken face and rubbed; about 5 percent fiber, less than 1 percent rubbed; weak medium subangular blocky structure; friable; few fine and medium roots; neutral; abrupt wavy boundary.

Oa3—18 to 23 inches; muck, black (N 2/0) broken face and rubbed; about 30 percent fiber, 5 percent rubbed; weak medium subangular blocky structure; friable; about 3 percent woody fragments; neutral; abrupt wavy boundary.

Oa4—23 to 34 inches; muck, black (N 2/0) broken face and rubbed; about 5 percent fiber, less than 1 percent rubbed; massive; friable; about 3 percent woody fragments; neutral; abrupt wavy boundary.

Cg—34 to 60 inches; grayish brown (10YR 5/2) sand; single grain; loose; black (10YR 2/1) organic stains throughout; about 3 percent woody fragments; about 3 percent fine gravel; slightly alkaline.

The thickness of the sapric material ranges from 16 to 51 inches. The content of woody fragments ranges from 0 to 5 percent in the sapric material. The content of gravel ranges from 0 to 15 percent in the Cg horizon.

The Cg horizon has hue of 10YR or is neutral in hue. It has value of 2 to 6 and chroma 0 to 4. It is sand or coarse sand.

Aeric Haplaquods, Sandy, Ortstein

These soils are sandy, mixed, mesic, ortstein Aeric Haplaquods. They are somewhat poorly drained soils on lake plains and outwash plains. They formed in sandy glaciofluvial deposits. Permeability is moderate in a cemented layer and rapid in the rest of the profile. Slope ranges from 0 to 4 percent.

Reference pedon of Aeric Haplaquods, sandy, ortstein, nearly level, 380 feet south and 2,000 feet east of the northwest corner of sec. 22, T. 13 N., R. 16 W., Greenwood Township:

Oi—0 to 1 inch; black (10YR 2/1), partially decomposed forest litter.

A—1 to 5 inches; very dark grayish brown (10YR 3/2) sand; weak medium granular structure; very friable; many very fine and fine roots; strongly acid; abrupt wavy boundary.

E—5 to 11 inches; pinkish gray (7.5YR 6/2) sand; few fine distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; very friable; strongly acid; abrupt irregular boundary.

Bhsm—11 to 17 inches; dark reddish brown (5YR 3/2) sand; massive; moderately cemented ortstein; strongly acid; clear irregular boundary.

Bs—17 to 24 inches; dark brown (7.5YR 4/4) sand; common fine distinct reddish yellow (7.5YR 6/8) mottles; single grain; loose; strongly acid; clear wavy boundary.

BC—24 to 31 inches; brown (7.5YR 5/4) sand; single grain; loose; strongly acid; gradual wavy boundary.

C—31 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; strongly acid.

The thickness of the solum ranges from 20 to 40 inches. The ortstein layer ranges from 2 to 30 inches in thickness and is slightly cemented to strongly cemented. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 to 3. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 to 3. The A and E horizons are dominantly sand, but the range includes fine sand and loamy sand.

The Bhsm horizon has hue of 5YR or 7.5YR, value of 2 to 4, and chroma of 2 or 3. The cementation is discontinuous in some pedons. The horizon is more than 90 percent ortstein. The Bs horizon has hue of 7.5YR, value of 3 to 5, and chroma of 4. The BC horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 4 to 6. The Bhsm, Bs, and BC horizons are sand, coarse sand, or loamy sand.

The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4. It is dominantly sand, but in some pedons strata of fine sand, coarse sand, or loamy sand are below a depth of 40 inches.

Alfic Haplorthods, Sandy

These soils are sandy, mixed, mesic Alfic Haplorthods. They are well drained soils on ground moraines and end moraines. They formed in sandy and loamy glacial deposits. Permeability is rapid. Slope ranges from 0 to 30 percent.

Reference pedon of Alfic Haplorthods, sandy, in an area of Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, nearly level and undulating, 20 feet north and 210 feet west of the southeast corner of sec. 7, T. 16 N., R. 15 W., Colfax Township:

Oe—0 to 2 inches; black (10YR 2/1), partially decomposed hardwood leaf litter.

A—2 to 4 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many very fine and fine roots; moderately acid; clear irregular boundary.

E—4 to 6 inches; light gray (10YR 7/2) sand; weak fine granular structure; very friable; many very fine and fine roots; moderately acid; clear irregular boundary.

Bs1—6 to 10 inches; dark yellowish brown (10YR 4/4) sand; weak medium subangular blocky structure; loose; moderately acid; gradual wavy boundary.

Bs2—10 to 24 inches; yellowish brown (10YR 5/6) sand; single grain; loose; moderately acid; abrupt wavy boundary.

Bs3—24 to 42 inches; brownish yellow (10YR 6/6) sand; single grain; loose; moderately acid; clear irregular boundary.

2Bt—42 to 52 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; few distinct dark brown (7.5YR 3/4) clay films on faces of peds; friable; slightly acid; abrupt wavy boundary.

3C1—52 to 84 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; slightly acid.

3C2—84 to 92 inches; yellowish brown (10YR 5/6) loamy sand; single grain; loose; slightly acid.

3C3—92 to 99 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; slightly acid.

The thickness of the solum ranges from 20 to 45 inches. The thickness of the loamy deposits ranges from 3 to 20 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4. The A and E horizons are sand or loamy sand. Some pedons do not have an E horizon.

The Bs horizon has hue of 5YR or 10YR and value and chroma of 3 to 6. It is sand or loamy sand. Some pedons have a BC horizon. This horizon is as much as 10 inches thick. It is loamy sand or sand.

The 2Bt horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 3 to 6. It is sandy loam, fine sandy loam, clay loam, loam, or silty clay loam.

The 3C horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 4 to 6. It stratified sand to sandy clay loam.

Alfic Haplorthods, Sandy Over Loamy

These soils are sandy over loamy, mixed, mesic Alfic Haplorthods. They are well drained soils on end moraines and ground moraines. They formed in sandy glacial drift over loamy glacial drift. Permeability is rapid in the sandy material and moderately slow in the loamy material. Slope ranges from 0 to 30 percent.

Reference pedon of Alfic Haplorthods, sandy over loamy, in an area of Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, nearly level and undulating, 2,420 feet west and 450 feet south of the northwest corner of sec. 7, T. 16 N., R. 15 W., Colfax Township:

O—0 to 1 inch; black (10YR 2/1), partially decomposed hardwood leaf litter.

A—1 to 3 inches; very dark grayish brown (10YR 3/2) sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; many very fine and fine roots; moderately acid; clear irregular boundary.

E—3 to 5 inches; grayish brown (10YR 5/2) sand; weak fine granular structure; very friable; many fine roots; moderately acid; clear irregular boundary.

Bs1—5 to 8 inches; dark yellowish brown (10YR 4/4) sand; weak medium subangular blocky structure; loose; moderately acid; gradual wavy boundary.

Bs2—8 to 22 inches; yellowish brown (10YR 5/6) sand; weak medium subangular blocky structure; loose; moderately acid; abrupt irregular boundary.

2Bt—22 to 34 inches; brown (7.5YR 5/4) sandy clay loam; moderate medium subangular blocky structure; firm; dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine roots; neutral; abrupt wavy boundary.

3C1—34 to 73 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; neutral; gradual wavy boundary.

3C2—73 to 91 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; neutral; abrupt irregular boundary.

4C—91 to 99 inches; yellowish brown (10YR 5/4) sandy clay loam; neutral.

The thickness of the solum ranges from 20 to 40 inches. The thickness of the sandy material in the upper part of the profile also ranges from 20 to 40 inches. The thickness of the fine-loamy material ranges from 6 to 30 inches. The content of gravel ranges from 0 to 10 percent in the sandy material in the upper part of the profile and from 0 to 5 percent in the lower part of the profile.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4. The A and E horizons are sand or loamy sand.

The Bs horizon has hue of 5YR to 10YR and value and chroma of 3 to 6. It is sand, fine sand, or loamy sand. Some pedons have a BC horizon. This horizon is as much as 10 inches thick. It is loamy sand or sand.

The 2Bt horizon has hue of 5YR or 7.5YR and value and chroma of 3 to 6. It is sandy clay loam, clay loam, silt loam, or silty clay loam.

The 3C horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 4 to 6. It is stratified sand to sandy clay loam.

The 4C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 or 5. It is dominantly sandy clay loam, silt loam, or silty clay loam. In some pedons, however, it has strata of sand, fine sand, or loamy sand. The strata are less than 3 inches thick.

Algansee Series

The Algansee series consists of somewhat poorly drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. Slope ranges from 0 to 3 percent.

Typical pedon of Algansee loamy fine sand, occasionally flooded, 1,700 feet south and 100 feet east of the northwest corner of sec. 27, T. 14 N., R. 18 W., Benona Township:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy fine sand, brown (10YR 5/3) dry; moderate fine granular structure; very friable; neutral; abrupt wavy boundary.

C1—8 to 15 inches; brown (10YR 5/3) loamy fine sand; few fine distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure parting to single grain; very friable; few fine roots; very dark gray (10YR 3/1) organic stains throughout; neutral; clear irregular boundary.

C2—15 to 33 inches; brown (10YR 5/3) sand; common fine distinct strong brown (7.5YR 5/6) and few fine distinct light brownish gray (10YR 6/2) mottles; single grain; loose; few fine roots; very dark grayish brown (10YR 3/2) varves of loamy sand ½ inch to 3 inches thick; very dark gray (10YR 3/1) organic stains throughout; neutral; abrupt wavy boundary.

C3—33 to 36 inches; light yellowish brown (10YR 6/4) sand; common fine faint light brownish gray (10YR 6/2) mottles; single grain; loose; very dark gray (10YR 3/1) organic stains throughout; about 2 percent fine gravel; slightly alkaline; abrupt wavy boundary.

C4—36 to 44 inches; light yellowish brown (10YR 6/4) sand; common coarse prominent strong brown (7.5YR 4/6) mottles; single grain; loose; very dark gray (10YR 3/1) organic stains throughout; about 2 percent fine gravel; neutral; abrupt wavy boundary.

C5—44 to 60 inches; very dark gray (10YR 3/1) loamy fine sand; common medium faint dark gray (10YR 4/1) mottles; massive; friable; thin strata of black (10YR 2/1) mucky loamy sand 1 to 3 inches thick; very dark gray (10YR 3/1) organic stains throughout; about 5 percent woody fragments; slightly alkaline.

The content of gravel ranges from 0 to 3 percent throughout the profile. The content of organic carbon irregularly decreases with increasing depth.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes fine sand.

The C horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 2 to 4. It is loamy fine sand or sand.

Altmar Series

The Altmar series consists of somewhat poorly drained, rapidly permeable soils on valley trains and outwash plains. These soils formed in sandy glaciofluvial deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Altmar loamy fine sand, 0 to 3 percent slopes, 800 feet west and 50 feet north of the southeast corner of sec. 5, T. 14 N., R. 17 W., Shelby Township:

Ap—0 to 9 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak medium granular structure; friable; about 3 percent fine and medium gravel; slightly acid; abrupt smooth boundary.

Bw1—9 to 21 inches; yellowish brown (10YR 5/4) loamy sand; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very friable; about 7 percent fine and medium gravel; neutral; clear wavy boundary.

Bw2—21 to 24 inches; strong brown (7.5YR 4/6) loamy sand; common fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very friable; about 15 percent fine and medium gravel; about 2 percent cobbles; neutral; clear wavy boundary.

2C—24 to 60 inches; brown (10YR 5/3) gravelly sand; common fine distinct light brownish gray (10YR 6/2) mottles; single grain; loose; about 30 percent fine, medium, and coarse gravel; about 4 percent cobbles; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 18 to 36 inches. The content of gravel ranges from 1 to 20 percent in the solum.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes loamy sand and sandy loam.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is loamy sand or sand.

The 2C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is gravelly sand or stratified sand and gravel. The content of gravel ranges from 15 to 30 percent.

Alvin Series

The Alvin series consists of well drained, moderately rapidly permeable soils on outwash plains and terraces. These soils formed in loamy glaciofluvial deposits over sandy glaciofluvial deposits. Slope ranges from 0 to 18 percent.

Typical pedon of Alvin fine sandy loam, in an area of Alvin-Spinks complex, 0 to 6 percent slopes, 1,060 feet west and 30 feet north of the southeast corner of sec. 13, T. 16 N., R. 16 W., Crystal Township:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; about 2 percent fine gravel; neutral; abrupt smooth boundary.

E—8 to 15 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium subangular blocky structure; very friable; about 2 percent fine gravel; neutral; clear wavy boundary.

Bt—15 to 22 inches; strong brown (7.5YR 5/6) fine sandy loam; moderate medium subangular blocky structure; friable; colloid in bridges between mineral grains; about 5 percent fine gravel; neutral; clear irregular boundary.

Bt/E′—22 to 31 inches; about 90 percent strong brown (7.5YR 4/6) fine sandy loam (Bt); single grain; weak medium subangular blocky structure parting to massive; friable; colloid in bridges between mineral grains; surrounded by isolated remnants of pale brown (10YR 6/3) fine sandy loam (E′); about 3 percent fine gravel; neutral; abrupt wavy boundary.

2E and Bt—31 to 80 inches; pale brown (10YR 6/3) sand (E); single grain; discontinuous lamellae of dark brown (7.5YR 4/4) loamy sand (Bt) that are ¼ inch to 2 inches thick and have a total thickness of more than 6 inches; massive; friable; about 2 percent fine gravel; neutral.

The thickness of the solum ranges from 20 to 40 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2. It is dominantly fine sandy loam, but the range includes sandy loam and loamy fine sand.

The E horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is fine sandy loam, sandy loam, or loamy fine sand.

The Bt horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is fine sandy loam, sandy loam, or loam.

The E′ part of the Bt/E′ horizon has colors and textures similar to those of the E horizon. The Bt part has colors and textures similar to those of the Bt horizon.

The E part of the 2E and Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. The Bt part has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loamy sand or fine sandy loam.

Aquic Udipsamments

These soils are mixed, mesic Aquic Udipsamments. They are moderately well drained, rapidly permeable soils on outwash plains and flood plains. They formed in sandy outwash. Slope ranges from 0 to 4 percent.

Reference pedon of Aquic Udipsamments, nearly level, 1,120 feet east and 150 feet south of the northwest corner of sec. 22, T. 13 N., R. 16 W., Otto Township:

Oe—0 to 1 inch; partially decomposed hardwood leaf litter.

A—1 to 3 inches; very dark gray (10YR 3/1) sand; weak fine granular structure; very friable; many fine roots; strongly acid; clear wavy boundary.

E—3 to 7 inches; brown (10YR 5/3) sand; weak fine and medium granular structure; very friable; strongly acid; clear wavy boundary.

Bw—7 to 23 inches; dark yellowish brown (10YR 4/6) sand; weak fine subangular blocky structure; friable; strongly acid; gradual wavy boundary.

BC—23 to 41 inches; yellowish brown (10YR 5/4) sand; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; strongly acid; gradual wavy boundary.

C—41 to 60 inches; yellowish brown (10YR 5/4) sand; common medium distinct light brownish gray (10YR 6/2) mottles; single grain; loose; strongly acid.

The thickness of the solum ranges from 25 to 60 inches. The content of gravel ranges from 0 to 10 percent in the solum.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. It is dominantly sand, but the range includes loamy sand.

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 2 to 4. It is sand or loamy sand. It is 0 to 10 inches thick.

The Bw horizon has hue of 10YR and value and chroma of 4 to 6. It is sand, loamy sand, or fine sand.

The BC and C horizons have hue of 10YR, value of 5 or 6, and chroma of 3 to 6. Some pedons have strata of loamy sand to fine sandy loam below a depth of 60 inches.

Argic Udipsamments

These soils are mixed, mesic Argic Udipsamments. They are excessively drained, rapidly permeable soils on outwash plains and moraines. They formed in sandy outwash and glacial till. Slope ranges from 0 to 30 percent.

Reference pedon of Argic Udipsamments, nearly level and undulating, 400 feet west and 450 feet north of the southeast corner of sec. 4, T. 13 N., R. 15 W., Greenwood Township:

Oe—0 to 1 inch; black (10YR 2/1), partially decomposed hardwood leaf litter; many very fine and fine roots.

A—1 to 3 inches; very dark grayish brown (10YR 3/2) sand; weak fine granular structure; very friable; many fine roots; strongly acid; clear wavy boundary.

Bw1—3 to 18 inches; dark yellowish brown (10YR 4/6) sand; weak medium subangular blocky structure; very friable; common fine and medium roots; strongly acid; gradual wavy boundary.

Bw2—18 to 31 inches; yellowish brown (10YR 5/6) sand; single grain; loose; few fine and medium roots; slightly acid; gradual wavy boundary.

E and Bt—31 to 99 inches; light yellowish brown (10YR 6/4) sand (E); single grain; loose; lamellae of strong brown (7.5YR 4/6) and brown (7.5YR 5/4) loamy sand (Bt) that are ¼ to 1 inch thick and have a total thickness of less than 6 inches; about 10 percent gravel; slightly acid.

The thickness of the solum ranges from 30 to more than 100 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3.

The Bw horizon has hue of 10YR or 7.5YR and value and chroma of 3 to 6. It is sand or coarse sand.

The E part of the E and Bt horizon has hue of 10YR, value of 5 to 7, and chroma of 4 to 6. It is sand or coarse sand. The Bt part occurs as lamellae of loamy sand, loamy fine sand, or coarse sandy loam. The lamellae are ¼ inch to 2 inches thick and have a total thickness of less than 6 inches within a depth of 60 inches. They have hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. Some pedons have strata of loamy sand to fine sandy loam below a depth of 60 inches. The strata are 1 to 6 inches thick.

Arkona Series

The Arkona series consists of somewhat poorly drained soils on ground moraines and lake plains. These soils formed in sandy glaciofluvial deposits over clayey glacial till or in clayey glaciolacustrine deposits. Permeability is rapid in the upper part of the profile and very slow in the lower part. Slope ranges from 0 to 3 percent.

Typical pedon of Arkona loamy fine sand, 0 to 3 percent slopes, 2,400 feet west and 1,520 feet south of the northeast corner of sec. 23, T. 15 N., R. 15 W., Leavitt Township:

Ap—0 to 7 inches; very dark gray (10YR 3/1) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; strongly acid; abrupt smooth boundary.

E—7 to 14 inches; grayish brown (10YR 5/2) fine sand; single grain; loose; very dark gray (10YR 3/1) organic stains; strongly acid; abrupt irregular boundary.

Bs1—14 to 17 inches; dark brown (7.5YR 4/4) fine sand; common medium distinct strong brown (7.5YR 5/6) mottles; single grain; loose; about 25 percent chunks of weakly cemented, dark reddish brown (5YR 3/2) ortstein; slightly acid; gradual broken boundary.

Bs2—17 to 26 inches; strong brown (7.5YR 4/6) fine sand; common fine prominent light brownish gray (10YR 6/2) mottles; weakly cemented in place; single grain; loose; slightly acid; clear wavy boundary.

Bs3—26 to 31 inches; strong brown (7.5YR 5/6) fine sand; common coarse prominent light brownish gray (10YR 6/2) mottles; single grain; loose; slightly acid; clear wavy boundary.

2Bt—31 to 36 inches; dark brown (7.5YR 4/4) silty clay; common medium distinct light yellowish brown (10YR 6/4) mottles; strong medium subangular blocky structure; firm; few prominent gray (5Y 5/1) clay films on faces of peds; neutral; abrupt wavy boundary.

2C—36 to 60 inches; brown (5YR 5/3) silty clay; common medium distinct strong brown (7.5YR 5/8) and many medium prominent gray (5Y 5/1) mottles; massive; firm; about 5 percent fine gravel; strong effervescence; moderately alkaline.

Depth to the 2Bt horizon ranges from 20 to 40 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes loamy sand and fine sand.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is fine sand, sand, or loamy sand.

The Bs horizon has hue of 5YR to 10YR, value of 3 to 6, and chroma of 4 to 6. It is fine sand or sand.

The 2Bt horizon has hue of 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is silty clay or silty clay loam.

The 2C horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is silty clay or silty clay loam.

Arkport Series

The Arkport series consists of well drained, moderately rapidly permeable soils on glacial deltas and outwash plains. These soils formed in glaciofluvial deposits. Slope ranges from 0 to 18 percent.

Typical pedon of Arkport loamy very fine sand, in an area of Arkport-Chelsea complex, 0 to 6 percent slopes, 2,400 feet west and 2,500 feet north of the southeast corner of sec. 11, T. 13 N., R. 17 W., Grant Township:

Ap—0 to 8 inches; dark brown (10YR 4/3) loamy very fine sand, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; moderately acid; abrupt smooth boundary.

E—8 to 22 inches; yellowish brown (10YR 5/4) loamy very fine sand; massive; friable; strongly acid; abrupt wavy boundary.

E and Bt—22 to 60 inches; pale brown (10YR 6/3) very fine sand (E); lamellae of strong brown (7.5YR 5/6) very fine sandy loam (Bt) that are ¼ inch to 2 inches thick and have a total thickness of more than 6 inches; moderate thick platy structure; friable; strongly acid.

The thickness of the solum ranges from 40 to more than 60 inches. Depth to the uppermost lamella ranges from 15 to 30 inches.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. It is dominantly loamy very fine sand, but the range includes loamy fine sand and fine sand.

The E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. It is loamy very fine sand or very fine sand.

The E part of the E and Bt horizon has colors and textures similar to those of the E horizon. The Bt part occurs as lamellae that are ¼ inch to 2 inches thick and have a total thickness of more than 6 inches. The lamellae have hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 to 6. They are very fine sandy loam or loamy very fine sand.

Benona Series

The Benona series consists of excessively drained soils on end moraines, ground moraines, outwash plains, and lake plains. These soils formed in sandy glacial drift. Permeability is rapid throughout the profile or is rapid in the upper part of the profile and moderate in the lower part. Slope ranges from 0 to 70 percent.

Typical pedon of Benona sand, 0 to 6 percent slopes, 1,340 feet west and 1,980 feet north of the southeast corner of sec. 34, T. 15 N., R. 17 W., Hart Township:

Ap—0 to 8 inches; dark brown (10YR 3/3) sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; about 3 percent fine gravel; very strongly acid; abrupt smooth boundary.

Bs1—8 to 16 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; about 1 percent fine gravel; strongly acid; clear wavy boundary.

Bs2—16 to 24 inches; strong brown (7.5YR 4/6) sand; single grain; loose; about 3 percent fine gravel; strongly acid; gradual wavy boundary.

Bs3—24 to 46 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; about 2 percent fine gravel; strongly acid; abrupt wavy boundary.

E and Bt—46 to 60 inches; pale brown (10YR 6/3) sand (E); single grain; loose; discontinuous lamellae of strong brown (7.5YR 4/6) loamy sand (Bt) that are ¹⁄₁₆ to ⅛ inch thick and have a total thickness of less than 6 inches; weak fine granular structure; very friable; about 2 percent fine gravel; moderately acid.

The thickness of the solum ranges from 50 to more than 60 inches. Depth to the uppermost lamella ranges from 34 to 55 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. It is dominantly sand, but the range includes fine sand, loamy sand, and loamy fine sand. Some pedons have an E horizon.

The Bs horizon has hue of 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is sand, fine sand, or loamy sand.

The E part of the E and Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. The Bt part occurs as lamellae that are ¹⁄₁₆ to ¼ inch thick and have a total thickness of less than 6 inches. The lamellae have hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 to 6. They are sand or loamy sand.

Some pedons have a band of clay loam at a depth of 70 to 95 inches. The band is 1 to 12 inches thick.

Bono Series

The Bono series consists of very poorly drained, slowly permeable soils on lake plains and in depressional areas on ground moraines. These soils formed in clayey glacial till and glaciolacustrine deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Bono silt loam, 550 feet south and 125 feet east of the northwest corner of sec. 2, T. 15 N., R. 17 W., Hart Township:

Ap—0 to 11 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; slightly alkaline; abrupt smooth boundary.

BA—11 to 16 inches; dark gray (5Y 4/1) silty clay loam; common medium prominent light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; firm; few very dark gray (10YR 3/1) organic stains; slightly alkaline; clear wavy boundary.

Bg—16 to 26 inches; light gray (5Y 6/1) silty clay loam; common medium prominent light olive brown (2.5Y 5/6) mottles; strong medium subangular blocky structure; firm; few very dark gray (10YR 3/1) organic stains; slightly alkaline; clear wavy boundary.

BCg—26 to 32 inches; light gray (5Y 6/1) silty clay loam; common medium prominent light olive brown (2.5Y 5/6) mottles; strong medium subangular blocky structure; firm; few very dark gray (10YR 3/1) organic stains; slight effervescence; slightly alkaline; clear wavy boundary.

Cg—32 to 60 inches; olive gray (5Y 5/2) and light yellowish brown (2.5Y 6/4) silty clay loam; common coarse prominent light olive brown (2.5Y 5/6) mottles; massive; firm; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 25 to 40 inches. The content of gravel is 0 to 2 percent throughout the profile.

The Ap horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly silt loam, but the range includes silty clay loam.

The Bg horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam, silty clay, or clay.

The Cg horizon has hue of 5Y or 2.5Y, value of 3 to 6, and chroma of 1 to 3. It is silty clay loam, silty clay, or clay.

Capac Series

The Capac series consists of somewhat poorly drained, moderately slowly permeable soils on ground moraines. These soils formed in loamy glacial till. Slope ranges from 0 to 4 percent.

Typical pedon of Capac fine sandy loam, 0 to 4 percent slopes, 220 feet east and 60 feet south of the northwest corner of sec. 12, T. 13 N., R. 15 W., Greenwood Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; very dark grayish brown (10YR 3/2) organic stains; about 2 percent fine and medium gravel; slightly acid; abrupt smooth boundary.

E—9 to 14 inches; brown (10YR 5/3) fine sandy loam; few medium prominent strong brown (7.5YR 5/8) and few fine faint light brownish gray (10YR 6/2) mottles; moderate medium granular structure; friable; about 3 percent fine gravel; neutral; clear wavy boundary.

Bt/E—14 to 17 inches; about 60 percent brown (7.5YR 4/4) clay loam (Bt); common dark brown (7.5YR 3/2) clay skins on faces of peds; surrounded by brown (10YR 5/3) fine sandy loam (E); common coarse prominent strong brown (7.5YR 5/6 and 7.5YR 5/8) and common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; about 4 percent fine and medium gravel; neutral; clear wavy boundary.

Bt—17 to 36 inches; brown (7.5YR 4/4) silty clay loam; common medium distinct strong brown (7.5YR 5/8) and many fine distinct gray (5Y 5/1) mottles; moderate medium subangular blocky structure; firm; common dark brown (7.5YR 3/2) clay films on faces of peds; pale brown (10YR 6/3) silt coatings on faces of peds; about 4 percent fine and medium gravel; neutral; clear wavy boundary.

C1—36 to 48 inches; brown (10YR 5/3) loam; common fine distinct gray (5Y 5/1) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; about 6 percent fine and medium gravel; slight effervescence; moderately alkaline; clear wavy boundary.

C2—45 to 80 inches; brown (10YR 5/4) loam; common medium prominent gray (5Y 5/1) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; many soft light gray (10YR 7/1) accumulations of calcium carbonate; about 6 percent fine and medium gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 26 to 40 inches. The content of gravel ranges from 1 to 10 percent throughout the solum.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. It is dominantly fine sandy loam, but the range includes loam and silt loam.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 3. It is fine sandy loam, loam, or sandy loam.

The Bt part of the Bt/E horizon and the Bt horizon have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. They are silty clay loam or clay loam. The E part of the Bt/E horizon has colors and textures similar to those of the E horizon.

The C horizon has hue of 10YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is loam or clay loam.

Carlisle Series

The Carlisle series consists of very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on outwash plains, lake plains, and ground moraines. These soils formed in woody, mucky deposits more than 51 inches thick. Slope ranges from 0 to 2 percent.

Typical pedon of Carlisle muck, in an area of Houghton and Carlisle soils, 1,300 feet north and 50 feet west of the southeast corner of sec. 12, T. 14 N., R. 15 W., Newfield Township:

Oa1—0 to 10 inches; muck, black (N 2/0) broken face and rubbed; about 10 percent fiber, less than 1 percent rubbed; weak medium granular structure; friable; about 5 percent woody fragments; common fine, medium, and coarse roots; neutral; abrupt smooth boundary.

Oa2—10 to 21 inches; muck, black (5YR 2/1) broken face and rubbed; about 10 percent fiber, less than 1 percent rubbed; massive; friable; about 15 percent woody fragments; few fine and medium roots; neutral; clear smooth boundary.

Oa3—21 to 42 inches; muck, black (N 2/0) broken face and rubbed; about 15 percent fiber, less than 1 percent rubbed; massive; friable; about 3 percent woody fragments; neutral; clear smooth boundary.

Oa4—42 to 60 inches; muck, black (N 2/0) broken face and rubbed; about 30 percent fiber, 10 percent rubbed; massive; friable; about 15 percent woody fragments; neutral.

The organic material is more than 51 inches thick. The organic fibers are derived primarily from woody material. The content of woody fragments ranges from 3 to 15 percent throughout the profile.

The surface tier has hue of 10YR or is neutral in hue. It has value of 1 or 2 and chroma of 0 to 2. The subsurface tier has hue of 5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2.

Chelsea Series

The Chelsea series consists of excessively drained, rapidly permeable soils on glacial deltas, lake plains, and end moraines. These soils formed in sandy eolian material. Slope ranges from 0 to 18 percent.

Typical pedon of Chelsea fine sand, 0 to 6 percent slopes, 1,400 feet north and 1,490 feet west of the southeast corner of sec. 26, T. 13 N., R. 15 W., Greenwood Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

E1—9 to 17 inches; strong brown (7.5YR 4/6) fine sand; single grain; loose; about 2 percent fine gravel; neutral; gradual wavy boundary.

E2—17 to 26 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; about 2 percent fine gravel; neutral; gradual wavy boundary.

E3—26 to 39 inches; brownish yellow (10YR 6/6) fine sand; single grain; loose; neutral; gradual smooth boundary.

E and Bt—39 to 60 inches; light yellowish brown (10YR 6/4) fine sand (E); discontinuous lamellae of strong brown (7.5YR 5/6) and dark brown (7.5YR 4/4) loamy fine sand (Bt) that are 1/16 to 1/8 inch thick and have a total thickness of less than 6 inches; single grain; loose; neutral.

The thickness of the solum ranges from 48 to more than 60 inches. Depth to the uppermost lamella ranges from 36 to 50 inches.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. It is dominantly fine sand, but the range includes loamy fine sand. The E horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6.

The E part of the E and Bt horizon has colors and textures similar to those of the E horizon. The Bt part occurs as lamellae that are 1/16 to 1/4 inch thick and have a total thickness of less than 6 inches. The lamellae have hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 to 6. They are fine sand or loamy fine sand.

Claybanks Series

The Claybanks series consists of well drained, slowly permeable soils on ground moraines. These soils formed in clayey glacial till. Slope ranges from 1 to 12 percent.

Typical pedon of Claybanks silt loam, 1 to 6 percent slopes, 1,400 feet west and 20 feet south of the northeast corner of sec. 35, T. 13 N., R. 18 W., Claybanks Township:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; about 3 percent fine gravel; neutral; abrupt smooth boundary.

E/Bt—7 to 11 inches; about 65 percent light brownish gray (10YR 6/2) silt loam (E) occurring as tongues (more than 5 millimeters wide) that extend into or completely surround isolated remnants of reddish brown (5YR 4/4) silty clay (Bt); many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; many faint reddish brown (5YR 4/3) clay films on faces of peds; few fine roots; very dark grayish brown (10YR 3/2) organic stains in root channels and pores; about 3 percent fine gravel; neutral; clear wavy boundary.

Bt1—11 to 17 inches; reddish brown (5YR 4/4) clay; few medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure parting to strong fine angular blocky; firm; few fine roots; many faint reddish brown (5YR 4/3) clay films on faces of peds; about 3 percent fine gravel; neutral; clear wavy boundary.

Bt2—17 to 20 inches; brown (10YR 4/3) clay; common distinct dark gray (10YR 4/1) mottles; strong medium angular blocky structure; firm; few fine roots; many prominent reddish brown (5YR 4/3) clay films on faces of peds; about 3 percent fine gravel; slight effervescence; slightly alkaline; clear wavy boundary.

C—20 to 60 inches; pale brown (10YR 6/3) clay; common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; common medium pinkish white (7.5YR 8/2) soft masses of lime; about 5 percent fine gravel; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 18 to 36 inches. The content of gravel ranges from 2 to 10 percent throughout the profile.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is silt loam, loam, or clay loam.

The E part of the E/Bt horizon has value of 4 to 6 and chroma of 2 or 3. It has textures similar to those of the Ap horizon. The Bt part has colors and textures similar to those of the underlying Bt horizon.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is clay or silty clay.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is clay or silty clay.

Cohoctah Series

The Cohoctah series consists of poorly drained, moderately rapidly permeable soils on flood plains. These soils formed in loamy alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Cohoctah fine sandy loam, occasionally flooded, 2,400 feet north and 620 feet east of the southwest corner of sec. 5, T. 15 N., R. 17 W., Hart Township:

A—0 to 15 inches; black (10YR 2/1) fine sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine and medium roots; moderately alkaline; abrupt wavy boundary.

C—15 to 25 inches; brown (10YR 5/3) fine sandy loam; many medium prominent strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure parting to weak medium granular; friable; very dark brown (10YR 2/2) organic stains; common fine roots; moderately alkaline; clear wavy boundary.

Cg1—25 to 30 inches; gray (5Y 5/1) loam; common medium prominent dark brown (7.5YR 5/6 and 7.5YR 4/6) mottles; moderate coarse subangular blocky structure; friable; common very dark gray (10YR 3/1) organic stains; common fine roots; moderately alkaline; clear wavy boundary.

Cg2—30 to 38 inches; dark gray (5Y 4/1) loam; few medium prominent dark brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; friable; common very dark gray (10YR 3/1) organic stains; few fine roots; moderately alkaline; abrupt wavy boundary.

Cg3—38 to 52 inches; very dark gray (10YR 3/1) silt loam; massive; firm; about 2 percent woody fragments; few fine roots; moderately alkaline; clear wavy boundary.

Cg4—52 to 60 inches; very dark gray (10YR 4/1) silt loam; massive; firm; about 10 percent woody fragments; few fine roots; moderately alkaline.

The content of gravel ranges from 0 to 3 percent throughout the profile. The content of organic carbon decreases irregularly with increasing depth.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is fine sandy loam, loam, or sandy loam.

The C horizon has hue of 5Y to 10YR, value of 3 to

6, and chroma of 1 to 4. It is dominantly fine sandy loam, loam, silt loam, or sandy loam. In some pedons, however, it has thin layers or lenses of sand or gravelly sand.

Coloma Series

The Coloma series consists of excessively drained, rapidly permeable soils on ground moraines, end moraines, and outwash plains. These soils formed in sandy glacial drift. Slope ranges from 0 to 35 percent.

Typical pedon of Coloma sand, 6 to 18 percent slopes, 1,240 feet north and 1,300 feet west of the southeast corner of sec. 24, T. 14 N., R. 17 W., Shelby Township:

A—0 to 4 inches; very dark grayish brown (10YR 3/2) sand, brown (10YR 4/3) dry; weak fine granular structure; very friable; common fine and few medium roots; about 3 percent fine gravel; strongly acid; abrupt wavy boundary.

E1—4 to 18 inches; yellowish brown (10YR 5/6) sand; weak fine granular structure parting to single grain; loose; few fine roots; about 3 percent fine gravel; very strongly acid; gradual wavy boundary.

E2—18 to 35 inches; brownish yellow (10YR 6/6) sand; single grain; loose; few fine roots; about 5 percent fine gravel; strongly acid; gradual wavy boundary.

E and Bt—35 to 60 inches; light yellowish brown (10YR 6/4) sand (E); single grain; loose; discontinuous lamellae of dark brown (10YR 4/4) loamy sand (Bt) that are 1/16 to 1/8 inch thick and have a total thickness of less than 6 inches; loose; clay bridging between sand grains; about 3 percent fine gravel; strongly acid.

The thickness of the solum ranges from 50 to 60 inches. Depth to the uppermost lamella ranges from 34 to 45 inches. The content of gravel ranges from 0 to 10 percent throughout the solum.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. It is dominantly sand, but the range includes loamy sand. The E horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6.

The E part of the E and Bt horizon has colors and textures similar to those of the E horizon. The Bt part occurs as lamellae that are 1/16 to 1/8 inch thick and have a total thickness of less than 6 inches. The lamellae have hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 to 6. They are loamy sand or sandy loam.

Covert Series

The Covert series consists of moderately well drained, rapidly permeable soils on outwash plains and lake plains. These soils formed in sandy glacial drift. Slope ranges from 0 to 6 percent.

Typical pedon of Covert sand, 0 to 6 percent slopes, 2,200 feet east and 50 feet south of the northwest corner of sec. 34, T. 16 N., R. 18 W., Pentwater Township:

A—0 to 1 inch; black (10YR 2/1) sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; many medium roots; moderately acid; abrupt smooth boundary.

E—1 to 4 inches; grayish brown (10YR 5/2) sand; weak fine granular structure; loose; common fine, medium, and coarse roots; moderately acid; clear wavy boundary.

Bs1—4 to 16 inches; dark brown (7.5YR 4/4) sand; single grain; loose; few fine and common medium and coarse roots; moderately acid; clear irregular boundary.

Bs2—16 to 29 inches; strong brown (7.5YR 5/6) sand; single grain; loose; few fine and medium roots; slightly acid; gradual wavy boundary.

BC—29 to 33 inches; brownish yellow (10YR 6/6) sand; common fine faint light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/8) mottles; single grain; loose; few medium roots; slightly acid; clear wavy boundary.

C1—33 to 52 inches; pale brown (10YR 6/3) sand; common fine faint light brownish gray (10YR 6/2) mottles; single grain; loose; slightly acid; gradual wavy boundary.

C2—52 to 60 inches; brown (10YR 5/3) sand; single grain; loose; slightly acid.

The thickness of the solum ranges from 24 to 45 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1. The E horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 1 to 3. The Bs horizon has hue of 7.5YR or 10YR and value and chroma of 3 to 6. The C horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 1 to 8.

Del Rey Series

The Del Rey series consists of somewhat poorly drained, slowly permeable soils on lake plains. These soils formed in clayey glaciolacustrine deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Del Rey silt loam, 0 to 3 percent slopes, 2,650 feet east and 2,300 feet north of the southwest corner of sec. 25, T. 15 N., R. 15 W., Leavitt Township:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light gray (10YR 6/1) dry; moderate medium granular structure; friable; about 2 percent fine gravel; slightly alkaline; abrupt smooth boundary.

Bt1—8 to 18 inches; brown (10YR 5/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and fine grayish brown (10YR 5/2) mottles; strong medium subangular blocky structure; firm; common medium gray (N 5/0) clay skins on faces of peds; many fine grayish brown (10YR 5/2) silt coatings on faces of peds; common very dark grayish brown (10YR 3/2) organic stains; about 1 percent fine gravel; slightly alkaline; clear wavy boundary.

Bt2—18 to 27 inches; brown (10YR 5/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and fine grayish brown (10YR 5/2) mottles; strong medium subangular blocky structure; firm; many medium gray (N 5/0) clay skins on faces of peds; many fine grayish brown (10YR 5/2) silt coatings on faces of peds; about 1 percent fine gravel; slight effervescence; slightly alkaline; clear wavy boundary.

Bw1—27 to 32 inches; yellowish brown (10YR 5/4) silty clay loam; common coarse distinct yellowish brown (10YR 5/6) and fine grayish brown (10YR 5/2) mottles; strong medium subangular blocky structure; many fine grayish brown (10YR 5/2) silt coatings on faces of peds; firm; many soft fine light gray (10YR 7/1) accumulations of calcium carbonate; strong effervescence; moderately alkaline; abrupt wavy boundary.

Bw2—32 to 60 inches; yellowish brown (10YR 5/4) silt loam; common coarse distinct yellowish brown (10YR 5/8) and fine grayish brown (10YR 5/2) mottles; weak medium platy structure; friable; common soft medium light gray (10YR 7/1) accumulations of calcium carbonate; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to more than 60 inches. The content of gravel ranges from 0 to 3 percent throughout the solum.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam.

The Bt horizon has hue of 10YR or 5Y, value of 4 to 6, and chroma of 3 to 6. It is silty clay loam or silty clay. The content of clay ranges from 35 to 45 percent.

The Bw horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 1 to 6. It is silt loam or silty clay loam. Some pedons have a C horizon, which is stratified.

Dixboro Series

The Dixboro series consists of somewhat poorly drained, moderately permeable soils on lake plains and glacial deltas. These soils formed in stratified, loamy glaciofluvial deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Dixboro loamy very fine sand, 0 to 3 percent slopes, 2,560 feet west and 350 feet north of the southeast corner of sec. 31, T. 14 N., R. 17 W., Shelby Township:

Ap—0 to 9 inches; very dark gray (10YR 3/1) loamy very fine sand, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/4) very fine sandy loam; common fine faint grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium granular structure parting to weak medium subangular blocky; friable; common fine dark yellowish brown (10YR 4/4) clay skins on faces of peds; very dark gray (10YR 3/1) organic stains; neutral; clear wavy boundary.

Bt2—14 to 21 inches; yellowish brown (10YR 5/4) loamy very fine sand; common fine faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; common fine dark yellowish brown (10YR 4/4) clay skins on faces of peds; about 2 percent fine gravel; slightly alkaline; clear wavy boundary.

BC—21 to 24 inches; yellowish brown (10YR 5/4) loamy very fine sand; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common soft coarse light gray (10YR 7/1) accumulations of calcium carbonate; about 2 percent fine gravel; slightly alkaline; abrupt wavy boundary.

2C1—24 to 30 inches; pale brown (10YR 6/3), stratified very fine sandy loam, loamy very fine sand, and silt loam; common medium distinct yellowish brown (10YR 5/6) and faint grayish brown (10YR 5/2) mottles; massive; friable; many soft coarse light gray (10YR 7/1) accumulations of calcium carbonate in the strata of silt loam; about 3 percent fine gravel; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—30 to 60 inches; pale brown (10YR 6/3) very fine sandy loam; common medium distinct yellowish brown (10YR 5/6) and faint grayish brown (10YR 5/2) and few distinct yellowish brown (10YR 5/8) mottles; massive; friable; many soft medium light gray (10YR 7/1) accumulations of calcium carbonate; about 3 percent fine gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 40 inches. The content of gravel ranges from 0 to 3 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy very fine sand, but the range includes loamy fine sand and fine sandy loam.

The Bt horizon has hue of 10YR and value and chroma of 3 to 6. It is very fine sandy loam, loamy very fine sand, or silt loam.

The BC horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4. It is loamy very fine sand, very fine sandy loam, or silt loam.

The 2C horizon has value of 5 or 6 and chroma of 1 to 4. It is stratified very fine sandy loam, loamy very fine sand, or silt loam.

Entic Haplorthods, Sandy

These soils are sandy, mixed, mesic Entic Haplorthods. They are moderately well drained to excessively drained, rapidly permeable soils on ground moraines, end moraines, and outwash plains. They formed in sandy glacial deposits. Slope ranges from 0 to 60 percent.

Reference pedon of Entic Haplorthods, sandy, rolling, 2,460 feet west and 1,900 feet north of the southeast corner of sec. 25, T. 13 N., R. 17 W., Grant Township:

Oe—0 to 1 inch; partially decomposed hardwood and coniferous leaf litter.
A—1 to 3 inches; very dark gray (10YR 3/1) sand; weak fine granular structure; very friable; many very fine and fine roots; strongly acid; abrupt wavy boundary.
E—3 to 4 inches; light gray (10YR 7/2) sand; weak fine granular structure; very friable; common fine roots; strongly acid; clear irregular boundary.
Bs1—4 to 18 inches; dark brown (7.5YR 4/4) sand; weak fine subangular blocky structure; loose; strongly acid; gradual wavy boundary.
Bs2—18 to 38 inches; strong brown (7.5YR 5/6) sand; weak fine subangular blocky structure; loose; strongly acid; gradual wavy boundary.
BC—38 to 48 inches; yellowish brown (10YR 5/6) sand; single grain; loose; moderately acid; gradual wavy boundary.
C1—48 to 98 inches; pale brown (10YR 6/3) sand; single grain; loose; moderately acid.
C2—98 to 99 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; moderately acid.

The thickness of the solum ranges from 20 to 50 inches. The content of gravel ranges from 0 to 10 percent throughout the solum.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. It is dominantly sand, but the range includes fine sand and loamy sand.

The E horizon has hue of 10YR to 7.5YR, value of 5 to 7, and chroma of 2 to 4. It has textures similar to those of the A horizon. It is very thin and discontinuous. Some pedons do not have an E horizon.

The Bs horizon has hue of 10YR to 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is sand, loamy sand, or fine sand. The dark subsoil phase has a Bhs horizon, which is less than 3 inches thick and has hue of 5YR or 7.5YR and value and chroma of 2 or 3.

The BC and C horizons have hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 4 to 6. The C horizon is dominantly sand or gravelly sand. In some pedons, however, it has bands of loamy sand, sandy loam, sandy clay loam, or the gravelly analogs of those textures below a depth of 60 inches. Some pedons have a calcareous substratum. The content of gravel ranges from 0 to 35 percent in the C horizon.

Epworth Series

The Epworth series consists of well drained, rapidly permeable soils on beach ridges, lake plains, and outwash plains. These soils formed in eolian deposits. Slope ranges from 0 to 35 percent.

Typical pedon of Epworth fine sand, 0 to 6 percent slopes, 2,675 feet east and 15 feet north of the southwest corner of sec. 27, T. 16 N., R. 17 W., Weare Township:

A—0 to 1 inch; black (10YR 2/1) fine sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; many fine and common medium roots; very strongly acid; abrupt smooth boundary.
E—1 to 3 inches; grayish brown (10YR 4/2) fine sand; single grain; loose; many fine and common medium roots; very strongly acid; abrupt wavy boundary.
Bs1—3 to 17 inches; dark brown (7.5YR 4/4) fine sand; single grain; loose; common fine and medium and few coarse roots; strongly acid; gradual wavy boundary.
Bs2—17 to 24 inches; strong brown (7.5YR 5/6) fine sand; single grain; loose; few medium and coarse roots; moderately acid; clear wavy boundary.
C1—24 to 50 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; few medium roots; moderately acid; gradual wavy boundary.
C2—50 to 60 inches; brownish yellow (10YR 6/6) fine sand; single grain; loose; moderately acid.

The thickness of the solum ranges from 20 to 32 inches. The content of gravel ranges from 0 to 3 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bs horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 8. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6.

Fern Series

The Fern series consists of well drained soils on ground moraines and end moraines (fig. 9). These soils formed in sandy glacial drift over loamy glacial drift. Permeability is rapid in the upper part of the profile and moderate in the lower part. Slope ranges from 0 to 35 percent.

Typical pedon of Fern loamy fine sand, 0 to 6 percent slopes, 900 feet east and 500 feet south of the northwest corner of sec. 8, T. 13 N., R. 16 W., Otto Township:

Ap—0 to 10 inches; dark brown (10YR 3/3) loamy fine sand, light brownish gray (10YR 6/2) dry; moderate medium granular structure; very friable; slightly acid; abrupt smooth boundary.

E—10 to 21 inches; brown (7.5YR 5/4) loamy fine sand; weak medium granular structure; very friable; neutral; clear wavy boundary.

2E/Bt—21 to 30 inches; about 80 percent tongues of pale brown (10YR 6/3) loamy fine sand (E); extending into or surrounding brown or dark brown (7.5YR 4/4) loam (Bt); moderate medium subangular blocky structure; friable; slightly acid; about 3 percent fine gravel; clear wavy boundary.

2Bt/E—30 to 51 inches; about 80 percent reddish brown (5YR 4/4) clay loam (Bt); surrounded by pale brown (10YR 6/3) loamy fine sand (E); moderate coarse subangular blocky structure; firm; moderately acid; about 5 percent fine gravel; gradual wavy boundary.

2Bt—51 to 60 inches; dark brown (7.5YR 4/4) loam; weak coarse subangular blocky structure; friable; few faint reddish brown (5YR 4/4) discontinuous clay films on faces of peds; about 5 percent fine gravel; neutral.

The depth to loamy material ranges from 20 to 40 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes fine sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is loamy fine sand, fine sand, or loamy sand.

The E part of the 2E/Bt and 2Bt/E horizons has colors and textures similar to those of the E horizon. The B part has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam or loam.

Some pedons have a C horizon.

Freesoil Series

The Freesoil series consists of somewhat poorly drained, moderately permeable soils on glacial deltas and lake plains. These soils formed in sandy and silty glaciofluvial deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Freesoil loamy very fine sand, 0 to 3 percent slopes, 2,400 feet north and 900 feet west of the southeast corner of sec. 11, T. 13 N., R. 17 W., Grant Township:

Ap—0 to 9 inches; very dark gray (10YR 3/1) loamy very fine sand, light gray (10YR 6/1) dry; weak medium granular structure; friable; slightly alkaline; abrupt smooth boundary.

Bw1—9 to 20 inches; yellowish brown (10YR 5/4) loamy very fine sand; common coarse prominent strong brown (7.5YR 5/8) and common fine distinct gray (10YR 5/1) mottles; moderate thick platy structure parting to weak medium subangular blocky; friable; slightly alkaline; clear wavy boundary.

Bw2—20 to 24 inches; yellowish brown (10YR 5/4) loamy very fine sand; common fine distinct gray (10YR 5/1) mottles; moderate thick platy structure; friable; slightly alkaline; clear wavy boundary.

C—24 to 60 inches; brown (10YR 5/3), stratified loamy very fine sand and very fine sand having bands of strong brown (7.5YR 5/6) silt ¼ to ½ inch thick; common coarse distinct gray (10YR 5/1) mottles; moderate thick platy structure; very friable; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The Ap horizon has value of 3 and chroma of 2 or 3. The Bw horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 4. It is loamy very fine sand or fine sandy loam. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is loamy very fine sand, very fine sand, or silt.

Glendora Series

The Glendora series consists of very poorly drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Glendora mucky loamy fine sand,

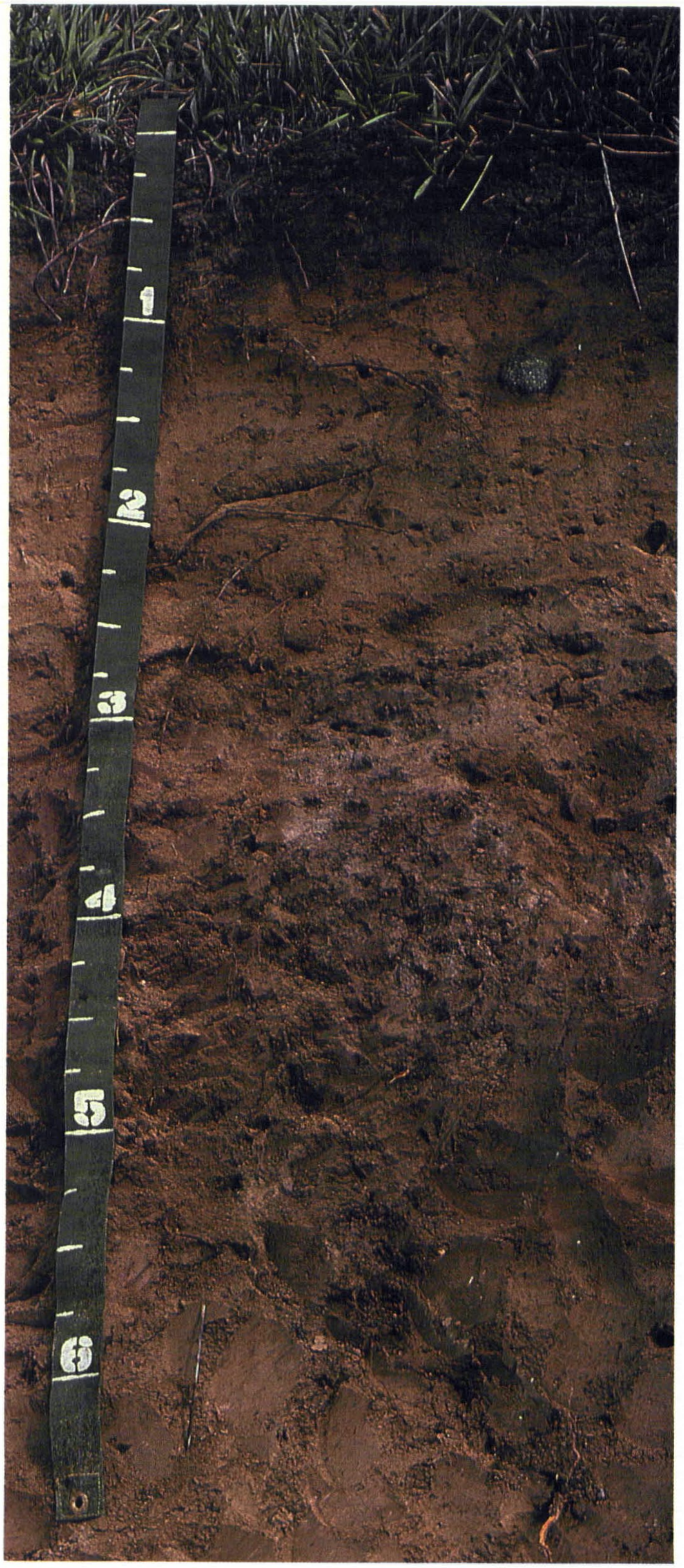

Figure 9.—Typical profile of a Fern loamy fine sand. Depth is marked in feet.

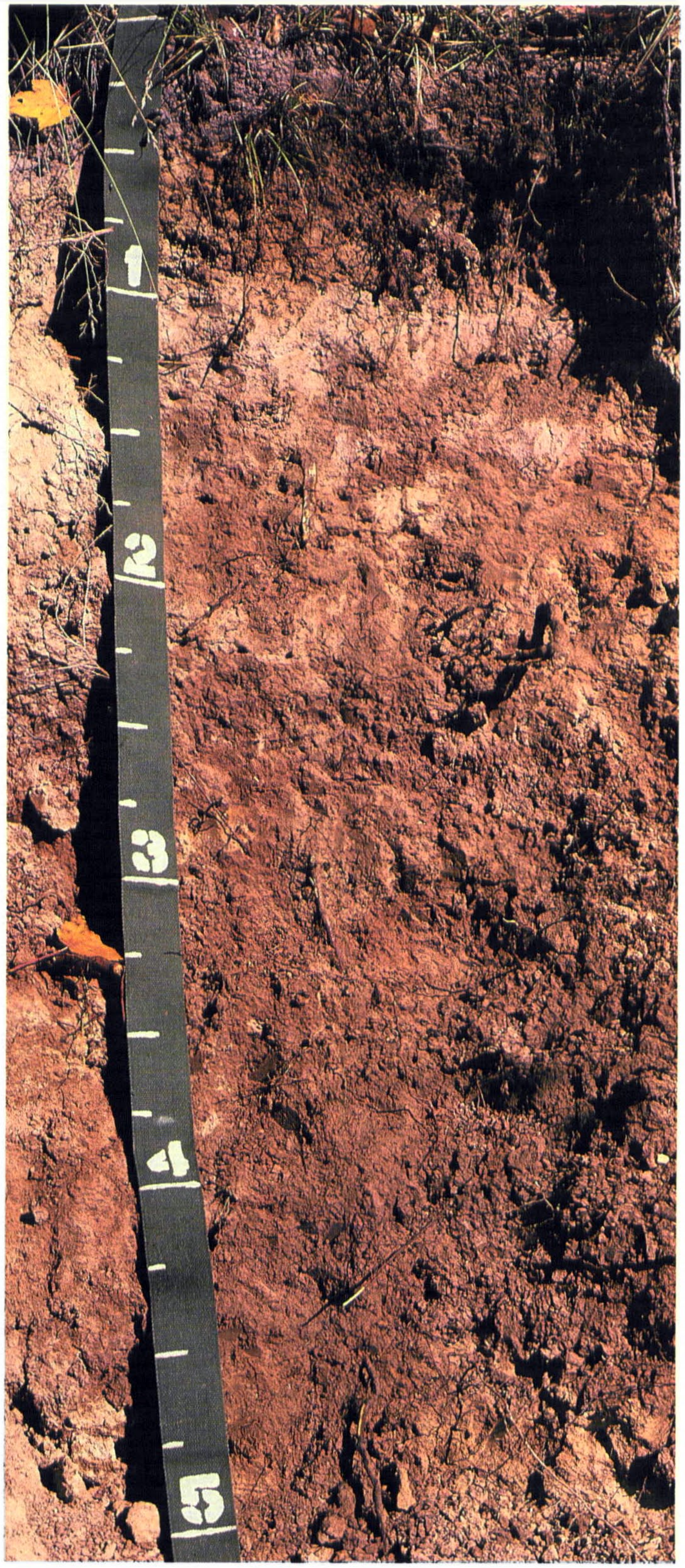

Figure 10.—Typical profile of a Perrinton loam. Depth is marked in feet.

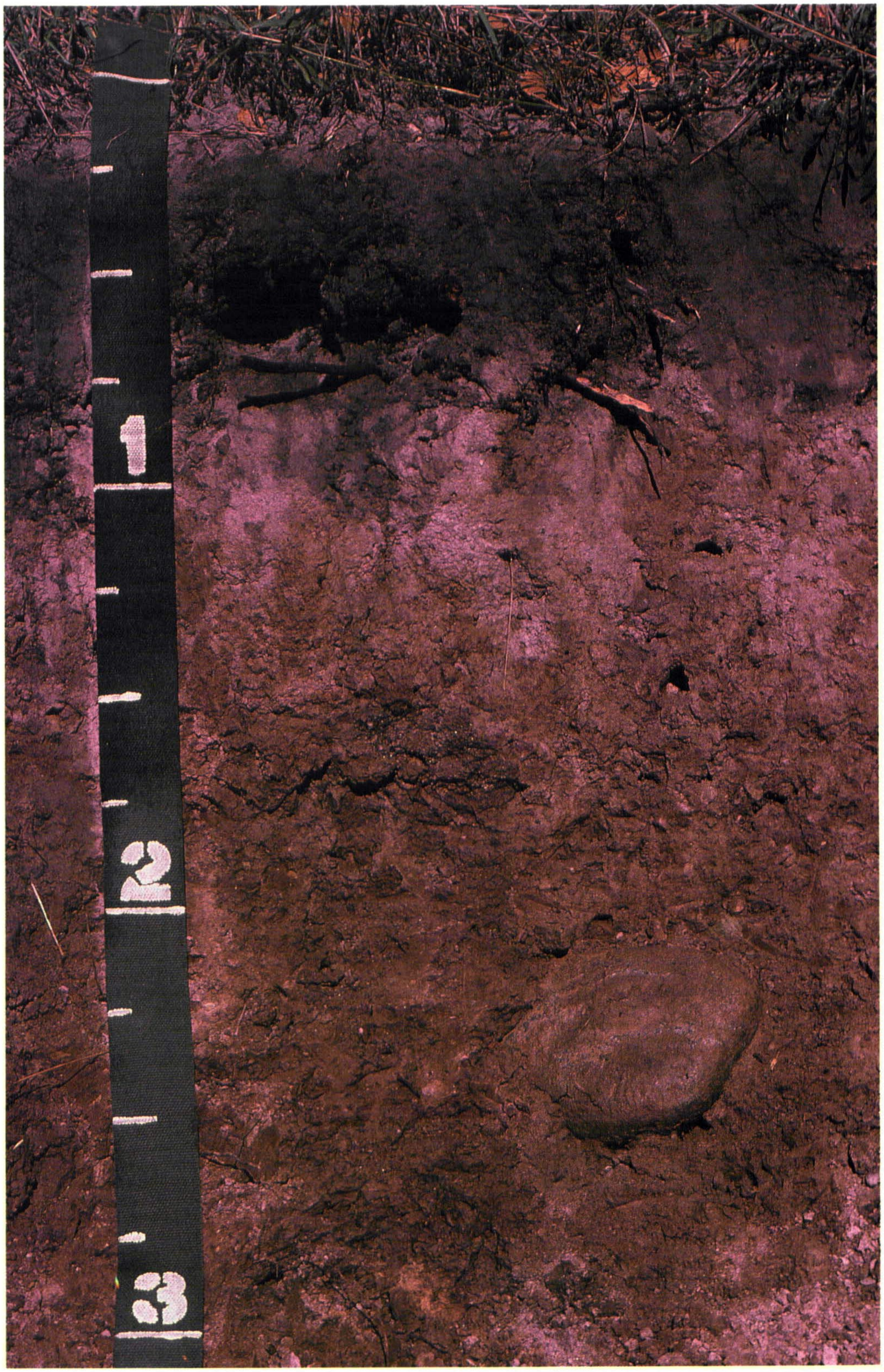

Figure 11.—Typical profile of a Remus fine sandy loam. Depth is marked in feet.

frequently flooded, 2,150 feet east and 100 feet north of the southwest corner of sec. 13, T. 13 N., R. 15 W., Greenwood Township:

A—0 to 8 inches; black (10YR 2/1) mucky loamy fine sand, gray (10YR 5/1) dry; weak fine granular structure; friable; common fine and medium and few coarse roots; slightly alkaline; clear wavy boundary.
Cg1—8 to 20 inches; gray (5Y 5/1) sand; single grain; loose; few fine, medium, and coarse roots; black (10YR 2/1) organic stains; slightly alkaline; clear wavy boundary.
Cg2—20 to 24 inches; gray (5Y 5/1) sand; single grain; loose; few medium roots; discontinuous strata of very dark gray (10YR 3/1) fine sandy loam ¼ to 1 inch thick; black (10YR 2/1) organic stains; slightly alkaline; abrupt wavy boundary.
Cg3—24 to 33 inches; very dark gray (10YR 3/1) loamy fine sand; massive; very friable; about 5 percent woody fragments; slightly alkaline; abrupt wavy boundary.
Cg4—33 to 60 inches; gray (5Y 5/1) sand; single grain; loose; slightly alkaline; about 2 percent fine gravel.

The content of gravel ranges from 0 to 3 percent throughout the profile. The content of organic carbon decreases irregularly with increasing depth.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly mucky loamy fine sand, but the range includes loamy fine sand, loamy sand, sand, mucky loamy sand, and mucky sand.

The Cg horizon has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 to 4. It is mainly sand or loamy fine sand. In some pedons it has pockets of gravel.

Gowdy Series

The Gowdy series consists of well drained soils on ground moraines and end moraines. These soils formed in sandy glaciofluvial deposits overlying silty clay loam glaciolacustrine deposits and glacial till. Permeability is rapid in the upper part of the profile and slow in the lower part. Slope ranges from 1 to 35 percent.

Typical pedon of Gowdy loamy fine sand, 1 to 6 percent slopes, 1,900 feet south and 1,600 feet west of the northeast corner of sec. 31, T. 16 N., R. 17 W., Crystal Township:

Ap—0 to 9 inches; dark brown (10YR 4/3) loamy fine sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; about 3 percent fine gravel; strongly acid; abrupt smooth boundary.
E1—9 to 16 inches; brown (10YR 5/3) fine sand, very pale brown (10YR 7/3) dry; single grain; loose; slightly acid; clear wavy boundary.
E2—16 to 28 inches; yellowish brown (10YR 5/6) fine sand, very pale brown (10YR 7/3) dry; single grain; loose; moderately acid; abrupt wavy boundary.
2Bt/E—28 to 32 inches; about 60 percent dark brown (7.5YR 4/4) silty clay loam (Bt); surrounded or penetrated by tongues of pale brown (10YR 6/3) fine sandy loam (E); moderate medium subangular blocky structure; firm; about 3 percent fine gravel; slightly acid; clear wavy boundary.
2Bt—32 to 42 inches; strong brown (7.5YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; common distinct dark brown (7.5YR 4/4) clay skins on faces of peds; about 5 percent fine gravel; neutral; clear wavy boundary.
2C—42 to 60 inches; strong brown (7.5YR 4/6) silty clay loam; massive; firm; about 5 percent fine gravel; slight effervescence; slightly alkaline.

Depth to the 2Bt/E horizon ranges from 20 to 36 inches. The content of gravel ranges from 0 to 5 percent in the sandy upper part of the solum and from 2 to 8 percent in the clayey lower part.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes fine sand and loamy sand.

The E horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 3 to 6. It is fine sand or sand.

The Bt part of the 2Bt/E horizon and the 2Bt horizon have hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. They are silty clay loam, silty clay, or clay. The E part of the 2Bt/E horizon has colors and textures similar to those of the E horizon.

The 2C horizon has hue of 7.5YR, 5YR, or 10YR and value and chroma of 3 to 6.

Granby Series

The Granby series consists of poorly drained soils on outwash plains and lake plains. These soils formed in sandy glaciofluvial deposits. Permeability is rapid throughout the profile or is rapid in the upper part of the profile and very rapid in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Granby sand, 1,310 feet south and 20 feet east of the northwest corner of sec. 19, T. 13 N., R. 17 W., Grant Township:

Ap—0 to 11 inches; black (10YR 2/1) sand, very dark gray (10YR 3/1) dry; weak medium granular structure; very friable; neutral; abrupt smooth boundary.
Bg—11 to 28 inches; light brownish gray (10YR 6/2) sand; single grain; loose; about 3 percent fine gravel; neutral; gradual wavy boundary.

Cg—28 to 60 inches; grayish brown (2.5Y 5/2) sand; single grain; loose; about 5 percent fine gravel; neutral.

The thickness of the solum ranges from 24 to 40 inches. The content of gravel ranges from 0 to 5 percent throughout the profile. The thickness of the mollic epipedon ranges from 10 to 15 inches. Some pedons have thin lenses or layers of silt loam, sandy loam, or sandy clay loam.

The Ap horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly sand, but the range includes fine sand, loamy sand, mucky sand, mucky fine sand, and mucky loamy sand.

The Bg horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 to 3. It is sand, loamy sand, or fine sand.

The C horizon has hue of 2.5Y, 5Y, or 10YR, value of 5 to 7, and chroma of 1 to 4. Some pedons have a gravelly substratum below a depth of 40 inches.

Grattan Series

The Grattan series consists of excessively drained soils on end moraines, outwash plains, and lake plains. These soils formed in sandy glaciofluvial deposits and glacial outwash. Permeability is rapid throughout the profile or is rapid in the upper part of the profile and slow or moderately slow in the lower part. Slope ranges from 0 to 70 percent.

Typical pedon of Grattan sand, 0 to 6 percent slopes, 160 feet south and 2,200 feet east of the northwest corner of sec. 32, T. 13 N., R. 17 W., Grant Township:

A—0 to 3 inches; very dark gray (10YR 3/1) sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; common medium and fine roots; very strongly acid; abrupt wavy boundary.

E—3 to 6 inches; grayish brown (10YR 5/2) sand; single grain; loose; common fine roots; strongly acid; clear irregular boundary.

Bs1—6 to 18 inches; dark brown (7.5YR 3/4) sand; single grain; loose; few fine roots; strongly acid; clear wavy boundary.

Bs2—18 to 32 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; moderately acid; about 3 percent fine gravel; gradual wavy boundary.

C—32 to 60 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; about 1 percent fine gravel; moderately acid.

The thickness of the solum ranges from 20 to 50 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 to 3. The E horizon has hue of 10YR or 7.5YR, value 5 or 6, and chroma of 1 or 2.

The Bs horizon has hue of 7.5YR, 10YR, or 5YR, value of 4 to 7, and chroma of 4 to 8. Some pedons have a Bhs horizon, which is less than 3 inches thick.

The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 3 to 6. It is sand or coarse sand. Some pedons have a substratum of clay loam below a depth of 40 inches.

Houghton Series

The Houghton series consists of very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on lake plains, outwash plains, and ground moraines. These soils formed in mucky deposits more than 51 inches thick. Slope ranges from 0 to 2 percent.

Typical pedon on Houghton mucky peat, in an area of Houghton and Carlisle soils, 800 feet north and 2,610 feet west of the southeast corner of sec. 13, T. 15 N., R. 15 W., Leavitt Township:

Oi—0 to 8 inches; mucky peat, very dark brown (10YR 2/2) broken face and rubbed, very dark brown (10YR 2/2) dry; massive; friable; common fine roots; neutral; abrupt smooth boundary.

Oa1—8 to 14 inches; muck, black (N 2/0) broken face and rubbed; about 5 percent fiber, less than 1 percent rubbed; moderate fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Oa2—14 to 24 inches; muck, black (N 2/0) broken face and rubbed; about 5 percent fiber, less than 1 percent rubbed; weak medium subangular blocky structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

Oa3—24 to 42 inches; muck, black (N 2/0) broken face and rubbed; about 30 percent fiber, 10 percent rubbed; weak thick platy structure; friable; neutral; abrupt smooth boundary.

Oa4—42 to 60 inches; muck, black (N 2/0) broken face and rubbed; about 15 percent fiber, 5 percent rubbed; massive; friable; neutral.

The organic material is more than 51 inches thick. The organic fibers are derived primarily from herbaceous material. The content of woody fragments ranges from 0 to 10 percent throughout the profile.

The surface tier has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. It is dominantly mucky peat, but the range includes muck. The subsurface tiers are neutral in hue and have value of 2 or 3.

Hoytville Series

The Hoytville series consists of very poorly drained, slowly permeable soils on ground moraines leveled by lake action. These soils formed in clayey and silty glacial till. Slope ranges from 0 to 2 percent.

Typical pedon of Hoytville silt loam, in an area of Nappanee-Hoytville silt loams, 0 to 4 percent slopes, 2,600 feet west and 2,560 feet north of the southeast corner of sec. 24, T. 13 N., R. 18 W., Claybanks Township:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; about 2 percent fine gravel; slightly alkaline; abrupt smooth boundary.

Btg1—9 to 18 inches; dark gray (5Y 4/1) silty clay; common coarse prominent strong brown (7.5YR 5/8) mottles; strong medium angular blocky structure; firm; black (10YR 2/1) organic stains; common fine dark greenish gray (5GB 4/1) clay films on faces of peds; about 2 percent fine gravel; slightly alkaline; clear wavy boundary.

Btg2—18 to 25 inches; greenish gray (5Y 5/1) silty clay; common coarse prominent yellowish brown (10YR 5/8) mottles; strong medium angular blocky structure; firm; black (10YR 2/1) organic stains; common faint dark greenish gray (5GB 4/1) clay films on faces of peds; about 2 percent fine gravel; slightly alkaline; clear wavy boundary.

Btg3—25 to 32 inches; dark gray (5Y 4/1) silty clay; common coarse prominent yellowish brown (10YR 5/8) and medium faint gray (5Y 6/1) mottles; strong medium angular blocky structure; firm; black (10YR 2/1) organic stains; few faint dark greenish gray (5GB 4/1) clay films on faces of peds; about 2 percent fine gravel; slightly alkaline; clear wavy boundary.

BC—32 to 44 inches; gray (5Y 6/1) silty clay; common coarse prominent yellowish brown (10YR 5/8) mottles; strong medium angular structure; firm; about 3 percent fine gravel; few soft medium light gray (10YR 7/1) masses of calcium carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C—44 to 60 inches; gray (5Y 6/1) clay; common coarse prominent yellowish brown (10YR 5/8) mottles; massive; firm; about 2 percent fine gravel; many soft medium light gray (10YR 7/1) masses of calcium carbonate; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 24 to 40 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silt loam, but the range includes clay loam and silty clay loam.

The Btg horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay or clay. The content of clay ranges from 45 to 60 percent.

The BC and C horizons have hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 to 3. They are silty clay or clay.

Ithaca Series

The Ithaca series consists of somewhat poorly drained, slowly permeable soils on ground moraines. These soils formed in loamy glacial till. Slope ranges from 0 to 3 percent.

Typical pedon of Ithaca loam, 0 to 3 percent slopes, 1,250 feet south and 90 feet east of the northwest corner of sec. 2, T. 16 N., R. 17 W., Weare Township:

Ap—0 to 9 inches; very dark gray (10YR 3/1) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; about 2 percent fine gravel; neutral; abrupt smooth boundary.

E/Bt—9 to 13 inches; about 60 percent pale brown (10YR 6/3) fine sandy loam (E); surrounded by dark brown (7.5YR 4/4) clay loam (Bt); moderate medium subangular blocky structure; firm; about 2 percent gravel; neutral; clear irregular boundary.

Bt—13 to 24 inches; dark brown (7.5YR 4/4) clay loam; common coarse distinct strong brown (7.5YR 5/8) and fine grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; light brownish gray (10YR 6/2) clay films on faces of peds; about 3 percent fine gravel; neutral; clear wavy boundary.

Bw1—24 to 27 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; about 2 percent fine gravel; few soft light gray (10YR 7/2) masses of calcium carbonate; slight effervescence; slightly alkaline; clear wavy boundary.

Bw2—27 to 60 inches; brown (10YR 5/3) clay loam; common medium distinct yellowish brown (10YR 5/8) and fine greenish gray (5BG 6/1) mottles; moderate medium subangular blocky structure; firm; about 3 percent fine gravel; many soft light gray (10YR 7/2) masses of calcium carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to more than 60 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The Ap horizon has hue of 10YR and value and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam.

The E part of the E/Bt horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is fine sandy loam or silt loam. Some pedons have an E horizon. The Bt part of the E/Bt horizon and the Bt horizon have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. They are clay loam or silty clay loam.

The Bw horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is clay loam or silty clay loam.

Jebavy Series

The Jebavy series consists of poorly drained soils on outwash plains and lake plains. These soils formed in sandy glaciofluvial deposits. Permeability is moderate in a cemented layer and rapid in the rest of the profile. Slope ranges from 0 to 2 percent.

Typical pedon of Jebavy fine sand, in an area of Saugatuck-Jebavy complex, 0 to 3 percent slopes, 1,440 feet north and 210 feet east of the southeast corner of sec. 25, T. 15 N., R. 17 W., Hart Township:

A—0 to 4 inches; black (10YR 2/1) fine sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; many fine, common medium, and few coarse roots; very strongly acid; abrupt wavy boundary.

E—4 to 12 inches; dark gray (10YR 4/1) fine sand; many fine faint light gray (10YR 6/1) mottles; single grain; loose; few fine, medium, and coarse roots; extremely acid; clear irregular boundary.

Bhs—12 to 16 inches; black (5YR 2.5/1) fine sand; common medium prominent strong brown (7.5YR 4/6), common medium distinct reddish brown (5YR 4/3), and few fine distinct brown (7.5YR (5/2) mottles; single grain; loose; weakly cemented; few fine roots; strongly acid; abrupt broken boundary.

Bs1—16 to 32 inches; yellowish brown (10YR 5/6) fine sand; many coarse prominent strong brown (7.5YR 5/8) and common medium distinct grayish brown (10YR 5/2) mottles; single grain; loose; strongly acid; clear wavy boundary.

Bs2—32 to 36 inches; yellowish brown (10YR 5/6) fine sand; common medium distinct grayish brown (10YR 5/2) mottles; single grain; loose; very strongly acid; clear wavy boundary.

C—36 to 60 inches; pale brown (10YR 6/3) sand; many fine faint light gray (10YR 6/1) and few medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; very strongly acid.

The thickness of the solum ranges from 28 to 40 inches. The soils are fine sand or sand throughout. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 1 or 2. The Bhs horizon has hue of 5YR or 7.5YR and value and chroma of 1 to 3. More than half of this horizon is cemented. The Bs horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 4 to 6. The C horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 2 to 4.

Kerston Series

The Kerston series consists of very poorly drained soils on flood plains. These soils formed in mucky deposits 16 to 30 inches deep over alternating layers of mineral and organic alluvium. Permeability is moderately slow to moderately rapid in the upper part of the profile and rapid in the sandy layers. Slope ranges from 0 to 2 percent.

Typical pedon of Kerston muck, in an area of Kerston and Carlisle mucks, frequently flooded, 1,920 feet north and 35 feet west of the southeast corner of sec. 15, T. 16 N., R. 17 W., Weare Township:

Oa1—0 to 13 inches; muck, black (N 2/0) broken face and rubbed, black (10YR 2/1) dry; about 10 percent fiber, less than 1 percent rubbed; weak medium granular structure; friable; common fine and medium roots; slightly acid; clear wavy boundary.

Oa2—13 to 26 inches; muck, black (N 2/0) broken face and rubbed; about 10 percent fiber, less than 1 percent rubbed; weak medium subangular blocky structure; friable; few fine roots; about 5 percent woody fragments; neutral; abrupt smooth boundary.

C—26 to 33 inches; light brownish gray (10YR 6/2) sand; massive; loose; many medium black (10YR 2/1) organic stains; neutral; abrupt wavy boundary.

O'a—33 to 46 inches; muck, black (10YR 2/1) broken face and rubbed; about 5 percent fiber, less than 1 percent rubbed; weak coarse subangular blocky structure; friable; common thin strata of light brownish gray (10YR 6/2) sand; neutral; abrupt irregular boundary.

C'—46 to 60 inches; light brownish gray (10YR 6/2) sand; massive; loose; common strata of black (10YR 2/1) muck ½ inch to 3 inches thick; neutral.

Depth to the C horizon ranges from 16 to 32 inches. The organic fibers are derived primarily from herbaceous material. The content of woody fragments ranges from 0 to 5 percent in the surface tier. The thickness and sequence of the organic layers vary in the control section.

The surface tier has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The C and

C′ horizons have hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. They are sand or loamy sand.

Kingsville Series

The Kingsville series consists of poorly drained, rapidly permeable soils on outwash plains and lake plains. These soils formed in sandy glaciofluvial deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Kingsville mucky sand, 2,600 feet south and 10 feet west of the northeast corner of sec. 1, T. 16 N., R. 15 W., Colfax Township:

A—0 to 7 inches; black (10YR 2/1) mucky sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; common fine and medium and few coarse roots; about 1 percent fine gravel; slightly acid; abrupt wavy boundary.

Bg1—7 to 16 inches; light brownish gray (10YR 6/2) sand; common medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; few fine and medium roots; black (10YR 2/1) organic stains in root channels and pores; about 1 percent fine gravel; neutral; clear wavy boundary.

Bg2—16 to 24 inches; light brownish gray (10YR 6/2) sand; single grain; loose; about 1 percent fine gravel; neutral; clear wavy boundary.

Cg—24 to 60 inches; light gray (10YR 7/2) sand; single grain; loose; about 3 percent fine gravel; neutral.

The thickness of the solum ranges from 24 to 35 inches. The content of gravel ranges from 0 to 5 percent throughout the solum.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly fine sand, but the range includes loamy sand. The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The Cg horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. It is sand or fine sand.

Lamson Series

The Lamson series consists of very poorly drained, moderately rapidly permeable soils on lake plains. These soils formed in sandy and loamy glaciofluvial and glaciolacustrine sediments. Slope ranges from 0 to 2 percent.

Typical pedon of Lamson muck, 800 feet north and 2,410 feet east of the southwest corner of sec. 6, T. 14 N., R. 15 W., Newfield Township:

Oa—0 to 7 inches; black (N 2/0) muck, black (N 2/0) dry; weak medium granular structure; friable; common fine, medium, and coarse roots; neutral; abrupt wavy boundary.

Bg—7 to 15 inches; light brownish gray (10YR 6/2) fine sand; few fine prominent strong brown (7.5YR 5/8) mottles; weak medium granular structure parting to single grain; very friable; neutral; clear irregular boundary.

Bw—15 to 22 inches; brown (10YR 5/3) loamy very fine sand; common medium prominent olive yellow (2.5Y 6/6) mottles; very friable; slightly alkaline; abrupt wavy boundary.

B′g—22 to 42 inches; gray (5Y 5/1) silt loam; few medium prominent olive yellow (2.5Y 6/6) mottles; strong thick platy structure; firm; moderately alkaline; abrupt wavy boundary.

C—42 to 80 inches; gray (10YR 6/1), stratified very fine sand, loamy very fine sand, and silt; massive; friable; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 35 to 50 inches.

The Oa horizon is neutral in hue and has value of 2, or it has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an A horizon. This horizon has colors similar to those of the Oa horizon. It is fine sandy loam, loamy fine sand, or the mucky analogs of those textures.

The Bg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is fine sand, loamy fine sand, or fine sandy loam.

The Bw horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is loamy very fine sand or very fine sandy loam.

The B′g horizon has colors similar to those of the Bg horizon. It is silt loam, fine sandy loam, or loam.

The C horizon has hue of 5Y to 10YR, value of 5 to 7, and chroma of 1 to 4. It is mainly stratified very fine sand, loamy very fine sand, silt, fine sand, or silt loam. In some pedons, however, it has subhorizons of silty clay loam.

Marlette Series

The Marlette series consists of well drained, moderately slowly permeable soils on ground moraines and end moraines. These soils formed in loamy glacial till. Slope ranges from 2 to 18 percent.

Typical pedon of Marlette fine sandy loam, 2 to 6 percent slopes, 1,700 feet west and 2,500 feet south of the northeast corner of sec. 34, T. 14 N., R. 18 W., Benona Township:

Ap—0 to 8 inches; very dark gray (10YR 3/1) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; about 2 percent fine gravel; slightly acid; abrupt smooth boundary

E/Bt—8 to 12 inches; 70 percent light brownish gray (10YR 6/2) fine sandy loam (E); surrounded by dark brown (7.5YR 4/4) clay loam (Bt); many coarse distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; few distinct clay films on faces on peds; very dark gray (10YR 3/1) organic stains; about 2 percent fine gravel; slightly acid; clear wavy boundary.

Bt1—12 to 18 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; many distinct clay films on faces of peds; about 3 percent fine gravel; slightly acid; clear wavy boundary.

Bt2—18 to 25 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; many distinct clay films on faces of peds; about 2 percent fine gravel; neutral; abrupt wavy boundary.

C1—25 to 38 inches; brown (7.5YR 5/4) clay loam; massive; firm; about 5 percent fine gravel; few soft light gray (10YR 7/1) masses of calcium carbonate; slight effervescence; slightly alkaline; clear wavy boundary.

C2—38 to 60 inches; brown (7.5YR 5/4) clay loam; massive; firm; about 5 percent fine gravel; many soft light gray (10YR 7/1) masses of calcium carbonate; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 20 to more than 60 inches. The content of gravel ranges from 2 to 10 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. It is dominantly fine sandy loam, but the range includes loam and silt loam.

The E part of the E/Bt horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is fine sandy loam or loam. Some pedons have a separate E horizon.

The Bt part of the E/Bt horizon and the Bt horizon have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. They are clay loam or silty clay loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. It is clay loam or silty clay loam.

Martisco Series

The Martisco series consists of very poorly drained soils in depressions on lake plains and ground moraines. These soils formed in as much as 16 inches of mucky deposits and in the underlying marl. Permeability is moderately slow to moderately rapid in the organic material and slow in the marl. Slope ranges from 0 to 2 percent.

Typical pedon of Martisco muck, 2,540 feet south and 1,900 feet east of the northwest corner of sec. 12, T. 14 N., R. 15 W., Newfield Township:

Oa1—0 to 10 inches; muck, black (10YR 2/1) broken face and rubbed; about 10 percent fiber, less than 1 percent rubbed; moderate fine granular structure; friable; common fine and medium roots; neutral; clear smooth boundary.

Oa2—10 to 15 inches; muck, black (10YR 2/1) broken face and rubbed; about 5 percent fiber, less than 1 percent rubbed; weak thick platy structure; friable; common fine and few medium roots; neutral; abrupt smooth boundary.

Cg—15 to 60 inches; light gray (10YR 7/1) marl; massive; friable; few medium roots; few small snail shells; strong effervescence; moderately alkaline.

The organic material is 8 to 16 inches thick. The organic fibers are derived primarily from herbaceous material.

The Oa horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1. The Cg horizon has hue of 5Y to 10YR, value of 5 to 7, and chroma of 1 or 2.

Mollic Psammaquents

These soils are mixed, mesic Mollic Psammaquents. They are poorly drained soils on flood plains, lake plains, and outwash plains. They formed in sandy glacial drift. Permeability is moderately rapid. Slope ranges from 0 to 2 percent.

Reference pedon of Mollic Psammaquents, nearly level, 600 feet east and 330 feet south of the northwest corner of sec. 22, T. 13 N., R. 16 W., Otto Township:

Oa—0 to 3 inches; black (10YR 2/1) muck; weak fine granular structure; friable; many very fine and fine roots; neutral; abrupt smooth boundary.

A—3 to 8 inches; black (10YR 2/1) sandy loam, gray (10YR 5/1) dry; weak fine granular structure; very friable; many very fine and fine roots; neutral; gradual smooth boundary.

Bg—8 to 20 inches; light brownish gray (10YR 6/2) sand; few medium distinct strong brown (7.5YR 5/6) mottles; weak fine granular structure; loose; neutral; clear wavy boundary.

C—20 to 30 inches; pale brown (10YR 6/3) sand; single grain; loose; neutral; clear wavy boundary.

Cg—30 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; neutral.

The thickness of the solum ranges from 20 to 40 inches. The organic surface layer is less than 7 inches thick. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. It is dominantly sandy loam, but the range includes fine sand and loamy sand.

The Bg horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. It is loamy sand, sand, or fine sand. Some pedons do not have a Bg horizon.

The C horizon has hue of 10YR or 2.5YR, value of 5 to 7, and chroma of 1 to 3. It is dominantly sand or loamy sand, but in some pedons it has strata of fine sand or coarse sand.

Napoleon Series

The Napoleon series consists of very poorly drained, moderately permeable or moderately rapidly permeable soils in depressions on ground moraines and lake plains. These soils formed in mucky deposits more than 51 inches thick. Slope ranges from 0 to 2 percent.

Typical pedon of Napoleon muck, 1,700 feet north and 100 feet west of the southeast corner of sec. 36, T. 16 N., R. 15 W., Colfax Township:

Oa1—0 to 4 inches; muck, dark reddish brown (5YR 3/3) broken face and rubbed, dark reddish brown (5YR 3/4) dry; about 30 percent fiber, 12 percent rubbed; common fine and medium roots; extremely acid; abrupt wavy boundary.

Oa2—4 to 11 inches; muck, black (5YR 2/1) broken face and rubbed; about 25 percent fiber, 10 percent rubbed; weak thick platy structure; friable; few fine roots; very strongly acid; clear smooth boundary.

Oe1—11 to 29 inches; mucky peat, dark reddish brown (5YR 2/2) broken face and rubbed; about 75 percent fiber, 25 percent rubbed; weak thick platy structure; friable; very strongly acid; clear smooth boundary.

Oe2—29 to 50 inches; mucky peat, black (5YR 2/1) broken face and rubbed; about 60 percent fiber, 20 percent rubbed; weak thick platy structure; friable; very strongly acid; clear smooth boundary.

Oe3—50 to 60 inches; mucky peat, black (5YR 2/1) broken face and rubbed; about 50 percent fiber, 20 percent rubbed; massive; friable; very strongly acid.

The organic material is more than 51 inches thick. The organic fibers are derived primarily from herbaceous material. The content of woody fragments ranges from 0 to 5 percent throughout the profile.

The surface and subsurface tiers have hue of 5YR or 10YR or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 2. The surface tier is dominantly muck, but the range includes mucky peat.

Nappanee Series

The Nappanee series consists of somewhat poorly drained, slowly permeable soils on ground moraines. These soils formed in clayey glacial till. Slope ranges from 0 to 4 percent.

Typical pedon of Nappanee silt loam, 0 to 4 percent slopes, 120 feet south and 1,760 feet east of the northwest corner of sec. 24, T. 13 N., R. 18 W., Claybanks Township:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, light gray (10YR 6/1) dry; moderate coarse granular structure parting to moderate medium subangular blocky; firm; about 2 percent fine gravel; neutral; abrupt smooth boundary.

Bt1—9 to 16 inches; dark yellowish brown (10YR 4/4) silty clay; common coarse prominent yellowish brown (10YR 5/6), common fine and medium distinct reddish brown (5YR 5/4), and few medium distinct gray (10YR 5/1) mottles; strong coarse angular blocky structure; firm; black (10YR 2/1) organic stains; many distinct greenish gray (5BG 5/1) clay films on faces of peds; about 2 percent fine gravel; moderately alkaline; clear wavy boundary.

Bt2—16 to 19 inches; dark yellowish brown (10YR 4/4) clay; common coarse prominent yellowish brown (10YR 5/6), common fine and medium distinct reddish brown (5YR 5/4), and common medium distinct gray (10YR 5/1) mottles; strong medium subangular blocky structure; firm; many distinct greenish gray (5BG 5/1) clay films on faces of peds; about 3 percent fine gravel; moderately alkaline; clear wavy boundary.

Bt3—19 to 23 inches; brown (10YR 4/3) silty clay; common fine and medium distinct reddish brown (5YR 5/4) mottles; strong medium angular blocky structure; firm; many distinct gray (5Y 5/1) clay skins on faces of peds; about 3 percent fine gravel; many soft medium light gray (10YR 7/1) masses of calcium carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

Bt4—23 to 60 inches; brown (10YR 4/3) silty clay; many coarse distinct reddish brown (5YR 5/3) mottles; weak coarse subangular blocky structure; firm; many distinct gray (5Y 5/1) clay skins on faces of peds; about 5 percent fine gravel; many soft coarse light gray (10YR 7/1) masses of calcium carbonate; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 18 to more than 60 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam.

The Bt1 and Bt2 horizons have hue of 10YR, value of 4 to 6, and chroma of 1 to 4. They are silty clay or clay. The content of clay ranges from 45 to 60 percent.

The Bt3 and Bt4 horizons have hue of 10YR, value of 4 to 6, and chroma of 2 to 4. They are silty clay or clay.

Nordhouse Series

The Nordhouse series consists of excessively drained, rapidly permeable soils on dunes. These soils formed in sandy eolian deposits. Slope ranges from 3 to 75 percent.

Typical pedon of Nordhouse fine sand, 18 to 75 percent slopes, 2,400 feet west and 2,000 feet south of the northeast corner of sec. 2, T. 16 N., R. 18 W., Pentwater Township:

A—0 to 1 inch; black (N 2/0) fine sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; common fine and medium and few coarse roots; strongly acid; abrupt smooth boundary.

E—1 to 8 inches; light brownish gray (10YR 6/2) fine sand; weak fine granular structure parting to single grain; loose; common medium and few fine and coarse roots; very strongly acid; clear wavy boundary.

Bs1—8 to 14 inches; strong brown (7.5YR 5/6) fine sand; single grain; loose; few medium and fine roots; very strongly acid; clear wavy boundary.

Bs2—14 to 34 inches; brownish yellow (10YR 6/6) fine sand; single grain; loose; few fine roots; strongly acid; gradual wavy boundary.

C1—34 to 50 inches; very pale brown (10YR 7/4) fine sand; single grain; loose; strongly acid; gradual wavy boundary.

C2—50 to 60 inches; very pale brown (10YR 7/3) fine sand; single grain; loose; strongly acid.

The thickness of the solum ranges from 23 to 50 inches. Many flecks of dark colored grains from the A horizon are throughout the profile.

The A horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 to 3. The Bs horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 6 to 8. The C horizon has hue of 10YR, value of 6 or 7, and chroma of 3 to 6.

Okee Series

The Okee series consists of well drained soils on ground moraines and end moraines. These soils formed in sandy glacial drift. Permeability is moderate in the upper part of the profile and moderately rapid in the lower part. Slope ranges from 0 to 35 percent.

Typical pedon of Okee loamy sand, in an area of Spinks-Okee complex, 6 to 12 percent slopes, 2,400 feet east and 1,350 feet north of the southwest corner of sec. 3, T. 16 N., R. 15 W., Colfax Township:

Ap—0 to 3 inches; black (N 2/0) loamy sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; common fine and medium and few coarse roots; about 3 percent fine and medium gravel; neutral; abrupt smooth boundary.

Bw1—3 to 15 inches; strong brown (7.5YR 4/6) loamy sand; weak medium subangular blocky structure; very friable; few fine, medium, and coarse roots; about 3 percent fine and medium gravel; neutral; clear wavy boundary.

Bw2—15 to 25 inches; strong brown (7.5YR 5/6) loamy sand; weak fine subangular blocky structure; very friable; few fine and medium roots; about 7 percent fine and medium gravel; slightly acid; clear wavy boundary.

2Bt—25 to 33 inches; dark brown (7.5YR 3/4) sandy loam; weak coarse subangular blocky structure; friable; many medium dark brown (10YR 4/4) clay skins on faces of peds; few medium roots; about 10 percent fine and medium gravel; neutral; abrupt irregular boundary.

2C1—33 to 40 inches; pale brown (10YR 6/3) very gravelly sand; single grain; loose; about 45 percent fine and medium gravel; about 5 percent cobbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

2C2—40 to 60 inches; pale brown (10YR 6/3), stratified sand and gravel; about 17 percent fine and medium gravel; single grain; loose; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 50 inches. The content of gravel ranges from 1 to 25 percent throughout the solum.

The Ap horizon has hue of 10YR or is neutral in hue. It has value of 3 to 5 and chroma of 0 to 3.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is loamy sand or loamy fine sand.

The 2Bt horizon has hue of 7.5YR or 5YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam, sandy clay loam, or the gravelly analogs of those textures.

The 2C horizon has value of 5 or 6 and chroma of 3 to 6. It is very gravelly sand, stratified sand and gravel, coarse sand, or sand.

Palms Series

The Palms series consists of very poorly drained soils in depressions on lake plains. These soils formed in mucky deposits 16 to 51 inches deep over loamy glaciolacustrine deposits. Permeability is moderately slow to moderately rapid in the organic material and moderately slow in the loamy material. Slope ranges from 0 to 2 percent.

Typical pedon of Palms muck, 2,000 feet east and 1,800 feet north of the southwest corner of sec. 24, T. 15 N., R. 15. W., Leavitt Township:

Oa1—0 to 10 inches; muck, black (N 2/0) broken face and rubbed; about 5 percent fiber, less than 1 percent rubbed; moderate medium granular structure; friable; common fine and medium roots; neutral; clear wavy boundary.

Oa2—10 to 15 inches; muck, black (N 2/0) broken face and rubbed; about 5 percent fiber, less than 1 percent rubbed; moderate medium granular structure; friable; common fine and medium roots; neutral; clear wavy boundary.

Oa3—15 to 18 inches; muck, dark reddish brown (5YR 2/2) broken face and rubbed; about 35 percent fiber, 5 percent rubbed; weak medium subangular blocky structure; friable; common fine and few medium roots; neutral; abrupt wavy boundary.

Cg1—18 to 21 inches; grayish brown (2.5Y 5/2) sandy loam; massive; friable; moderately alkaline; abrupt wavy boundary.

Cg2—21 to 60 inches; gray (5Y 5/1) and strong brown (7.5YR 5/6) silt loam; massive; firm; moderately alkaline.

Depth to the Cg horizon ranges from 16 to 48 inches. The organic fibers are derived primarily from woody material. The content of woody fragments ranges from 0 to 10 percent in the sapric material.

The surface tier is neutral in hue and has value of 2 or 3. The Cg horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is sandy loam, silt loam, or silty clay loam.

Perrinton Series

The Perrinton series consists of well drained, slowly permeable soils on ground moraines and end moraines (fig. 10). These soils formed in loamy glacial till. Slope ranges from 2 to 35 percent.

Typical pedon of Perrinton loam, 2 to 6 percent slopes, 1,800 feet south and 30 feet east of the northwest corner of sec. 9, T. 15 N., R. 18 W., Golden Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; about 3 percent fine gravel; moderately acid; abrupt smooth boundary.

E/Bt—9 to 18 inches; about 65 percent grayish brown (10YR 5/2) fine sandy loam (E); extending into or surrounding isolated remnants of dark brown (7.5YR 4/4) silty clay loam (Bt); common coarse prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; very dark grayish brown (10YR 3/2) organic stains; thin grayish brown (10YR 5/2) clay skins on faces of peds; about 3 percent fine gravel; moderately acid; clear irregular boundary.

Bt1—18 to 24 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; thick grayish brown (10YR 5/2) clay skins on faces of peds; about 3 percent fine gravel; slightly acid; clear wavy boundary.

Bt2—24 to 35 inches; strong brown (7.5YR 4/6) silty clay; moderate medium subangular blocky structure; firm; thick grayish brown (10YR 5/2) clay skins on faces of peds; about 3 percent fine gravel; slightly acid; clear wavy boundary.

C1—35 to 48 inches; dark brown (10YR 4/3) silty clay; massive; firm; about 5 percent fine and medium gravel; slight effervescence; moderately alkaline; clear wavy boundary.

C2—48 to 60 inches; yellowish brown (10YR 5/4) silty clay; massive; firm; about 5 percent fine and medium gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 40 inches. The content of gravel ranges from 2 to 8 percent throughout the solum.

The Ap horizon has value and chroma of 1 to 3. It is dominantly loam, but the range includes fine sandy loam and clay loam.

The E part of the E/Bt horizon has value of 4 to 6 and chroma of 2 to 4. It is fine sandy loam or loam. Some pedons have an E horizon.

The Bt part of the E/Bt horizon and the Bt horizon have hue of 5YR or 7.5YR and value and chroma of 4 to 6. They are silty clay loam, silty clay, or clay loam.

The C horizon has value of 4 to 6 and chroma of 3 or 4. It is silty clay or silty clay loam.

Pipestone Series

The Pipestone series consists of somewhat poorly drained, rapidly permeable soils on outwash plains and lake plains. These soils formed in sandy glaciofluvial deposits. Slope ranges from 0 to 4 percent.

Typical pedon of Pipestone fine sand, 0 to 4 percent slopes, 1,260 feet south and 440 feet west of the northeast corner of sec. 31, T. 15 N., R. 1 E., Golden Township:

A—0 to 2 inches; black (10YR 2/1) fine sand, very dark gray (10YR 3/1) dry; moderate fine granular structure; very friable; many fine and medium roots; very strongly acid; abrupt smooth boundary.

E—2 to 12 inches; light brownish gray (10YR 6/2) fine sand; single grain; loose; few fine and medium roots; very strongly acid; clear wavy boundary.

Bhs—12 to 18 inches; dark reddish brown (5YR 2/2) fine sand; common medium distinct dark reddish brown (5YR 3/4) mottles; single grain; loose; few fine roots; about 15 percent weakly cemented ortstein chunks; very strongly acid; clear irregular boundary.

Bs—18 to 38 inches; strong brown (7.5YR 5/6) sand; many medium distinct light brownish gray (10YR 6/2) mottles; single grain; loose; very strongly acid; gradual wavy boundary.

C—38 to 60 inches; yellowish brown (10YR 5/6) sand; many medium distinct light brownish gray (10YR 6/2) mottles; single grain; loose; very strongly acid.

The thickness of the solum ranges from 20 to 50 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2. It is dominantly fine sand, but the range includes sand and loamy fine sand.

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 3. It is fine sand or sand.

The Bhs horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3. It is fine sand or sand. The ortstein is exposed in 0 to 30 percent of the total surface area in a vertical cut through the horizon. The ortstein occurs in less than 50 percent of the pedon.

The Bs horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. It is sand or fine sand.

The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 6. It is sand or fine sand.

Plainfield Series

The Plainfield series consists of excessively drained, rapidly permeable soils on outwash plains and ground moraines. These soils formed in sandy glacial drift. Slope ranges from 0 to 18 percent.

Typical pedon of Plainfield sand, 0 to 6 percent slopes, 1,280 feet west and 120 feet north of the southeast corner of sec. 31, T. 13 N., R. 16 W., Otto Township:

A—0 to 3 inches; black (10YR 2/1) sand, very dark gray (10YR 3/1) dry; weak medium granular structure; very friable; many fine and medium and common coarse roots; strongly acid; abrupt smooth boundary.

Bw1—3 to 10 inches; dark brown (7.5YR 4/4) sand; single grain; very friable; common fine and medium and many coarse roots; about 1 percent fine gravel; slightly acid; gradual wavy boundary.

Bw2—10 to 30 inches; strong brown (7.5YR 4/6) sand; single grain; loose; few fine roots; moderately acid; about 2 percent fine gravel; gradual wavy boundary.

C—30 to 60 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; about 2 percent fine gravel; moderately acid.

The thickness of the solum ranges from 12 to 38 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 4 to 8. It is dominantly sand but has thin layers of fine sand or coarse sand in some pedons.

Remus Series

The Remus series consists of well drained, moderately slowly permeable soils on ground moraines and end moraines (fig. 11). These soils formed in loamy glacial till. Slope ranges from 1 to 35 percent.

Typical pedon of Remus fine sandy loam, 1 to 6 percent slopes, 2,600 feet west and 2,000 feet north of the southeast corner of sec. 27, T. 16 N., R. 17 W., Weare Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; very friable; about 2 percent fine gravel; neutral; abrupt smooth boundary.

E/Bt—9 to 21 inches; about 65 percent pale brown (10YR 6/3) loamy sand (E); surrounding dark brown (7.5YR 3/4) loam (Bt); common light brownish gray (10YR 6/2) clay skins on faces of peds; weak medium subangular blocky structure; friable; about 3 percent fine gravel; neutral; clear irregular boundary.

Bt1—21 to 38 inches; dark reddish brown (5YR 3/4) loam; moderate medium subangular blocky structure; firm; light brownish gray (10YR 6/2) clay films on faces of peds; about 3 percent fine gravel; neutral; clear wavy boundary.

Bt2—38 to 50 inches; brown (7.5YR 5/4) sandy clay loam; weak medium subangular blocky structure;

firm; colloid in bridges between mineral grains; about 5 percent fine gravel; neutral; clear wavy boundary.

C—50 to 60 inches; brown (7.5YR 5/4) sandy clay loam; massive; firm; about 2 percent fine gravel; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The content of gravel ranges from 1 to 15 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam.

The E part of the E/Bt horizon has hue of 10YR, value of 5 to 7, and chroma of 2 to 4. It is loamy sand or fine sandy loam.

The Bt part of the E/Bt horizon and the Bt horizon have hue of 5YR to 10YR, value of 3 to 5, and chroma of 4 to 6. They are loam, sandy clay loam, or sandy loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. It is mainly sandy clay loam or sandy loam. In some pedons, however, it has pockets of loamy sand or sand.

Saugatuck Series

The Saugatuck series consists of somewhat poorly drained soils on outwash plains and lake plains. These soils formed in sandy glaciofluvial deposits. Permeability is moderate in a cemented layer and rapid in the rest of the profile. Slope ranges from 0 to 3 percent.

Typical pedon of Saugatuck fine sand, in an area of Saugatuck-Jebavy complex, 0 to 3 percent slopes, 300 feet north and 120 feet east of the southwest corner of sec. 34, T. 16 N., R. 18 W., Pentwater Township:

A—0 to 3 inches; black (10YR 2/1) fine sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; many fine and medium and common coarse roots; strongly acid; abrupt wavy boundary.

E—3 to 7 inches; grayish brown (10YR 5/2) fine sand; few fine faint (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; many fine, medium, and coarse roots; strongly acid; abrupt irregular boundary.

Bhs—7 to 21 inches; dark reddish brown (5YR 2/2) fine sand; few medium distinct (5YR 4/3) mottles; single grain; loose; weakly cemented; few fine roots; moderately acid; clear irregular boundary.

Bs—21 to 29 inches; dark brown (7.5YR 3/4) fine sand; many fine distinct pinkish gray (7.5YR 6/2) mottles; single grain; loose; moderately acid; clear wavy boundary.

BC—29 to 38 inches; dark yellowish brown (10YR 4/6) fine sand; many coarse distinct light brownish gray (10YR 6/2) mottles; single grain; loose; moderately acid; gradual wavy boundary.

C—38 to 60 inches; yellowish brown (10YR 5/4) fine sand; many fine faint light brownish gray (10YR 6/2) mottles; single grain; loose; slightly acid.

The thickness of the solum ranges from 20 to 50 inches.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly fine sand, but the range includes loamy sand, loamy fine sand, and sand.

The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. It is fine sand or sand.

The Bhs horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3. It is fine sand or sand. More than half of the horizon is cemented.

The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. It is fine sand or sand.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 2 to 4. It is fine sand or sand.

Scalley Series

The Scalley series consists of well drained soils on ground moraines and end moraines. These soils formed in loamy deposits overlying sandy glacial drift. Permeability is moderately slow in the upper part of the profile and rapid in the lower part. Slope ranges from 0 to 18 percent.

Typical pedon of Scalley fine sandy loam, in an area of Spinks-Scalley complex, 0 to 6 percent slopes, 1,310 feet north and 100 feet east of the southwest corner of sec. 35, T. 14 N., R. 18 W., Benona Township:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; about 3 percent fine gravel; slightly acid; abrupt smooth boundary.

E/Bt—6 to 18 inches; about 75 percent tongues of brown (10YR 5/3) fine sandy loam (E); extending into or surrounding isolated remnants of reddish brown (5YR 4/3) clay loam (Bt); moderate medium subangular blocky structure; firm; few thin dark brown (7.5YR 4/4) clay films on faces of peds; about 3 percent fine gravel; slightly acid; clear wavy boundary.

Bt/E—18 to 22 inches; about 60 percent reddish brown (5YR 4/3) clay loam (Bt); few thin dark brown (7.5YR 4/4) clay films on faces of peds; surrounded or penetrated by tongues of brown (10YR 5/3) fine sandy loam (E); moderate medium subangular blocky structure; firm; about 3 percent fine gravel; slightly acid; clear wavy boundary.

Bt—22 to 34 inches; reddish brown (5YR 4/3) clay loam; moderate medium subangular blocky structure; firm; few thin dark brown (7.5YR 4/4) clay films on faces of peds; about 2 percent fine gravel; slightly acid; abrupt irregular boundary.

2C—34 to 80 inches; yellowish brown (10YR 5/4) sand; single grain; loose; few lamellae of dark brown (7.5YR 4/4) sandy loam ⅛ inch to 2 inches thick; massive; very friable; about 3 percent fine gravel; slightly acid.

The thickness of the solum ranges from 22 to 40 inches. The content of gravel ranges from 1 to 10 percent throughout the solum.

The Ap horizon has value of 3 or 4 and chroma of 2 to 4. It is dominantly fine sandy loam, but the range includes sandy loam.

The E part of the E/Bt and Bt/E horizons has value of 5 or 6 and chroma of 2 to 4. It is fine sandy loam or sandy loam. Some pedons have an E horizon.

The Bt part of the E/Bt and Bt/E horizons and the Bt horizon have hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 to 6. They are clay loam or silty clay loam.

The 2C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sand or loamy sand.

Sickles Series

The Sickles series consists of poorly drained soils on lake plains. These soils formed in sandy glaciofluvial deposits overlying clayey glaciolacustrine deposits. Permeability is rapid in the sandy material and very slow in the clayey material. Slope ranges from 0 to 2 percent.

Typical pedon of Sickles loamy sand, 160 feet west and 480 feet south of the northeast corner of sec. 2, T. 16 N., R. 15 W., Colfax Township:

A—0 to 9 inches; black (10YR 2/1) loamy sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; common fine and medium and few coarse roots; neutral; abrupt smooth boundary.

Cg1—9 to 17 inches; grayish brown (2.5Y 5/2) sand; common medium prominent strong brown (7.5YR 5/6) mottles; single grain; loose; few fine roots; about 2 percent fine gravel; neutral; clear wavy boundary.

Cg2—17 to 32 inches; grayish brown (2.5Y 5/2) sand; single grain; loose; about 7 percent fine gravel; neutral; abrupt wavy boundary.

2Cg—32 to 60 inches; dark gray (5Y 4/1) silty clay loam; few medium distinct olive (5Y 5/4) mottles; massive; firm; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 20 to 40 inches. The content of gravel ranges from 0 to 7 percent in the C horizon.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy sand, but the range includes fine sand, sand, mucky loamy sand, mucky fine sand, and mucky sand.

The Cg horizon has hue of 2.5Y or 10YR, value of 3 to 5, and chroma of 1 or 2. It is sand, fine sand, or loamy sand.

The 2Cg horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or silty clay.

Sloan Series

The Sloan series consists of very poorly drained, moderately slowly permeable soils on flood plains. These soils formed in loamy alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Sloan silt loam, frequently flooded, 450 feet west and 10 feet north of the southeast corner of sec. 27, T. 13 N., R. 18 W., Claybanks Township:

A1—0 to 7 inches; black (10YR 2/1) silt loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; common fine and medium roots; slightly acid; abrupt wavy boundary.

A2—7 to 14 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium granular structure; friable; common fine and few medium roots; slightly alkaline; abrupt smooth boundary.

Bg1—14 to 20 inches; gray (N 5/0) silty clay loam; common coarse prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; very dark gray (10YR 3/1) organic stains; slightly alkaline; clear wavy boundary.

Bg2—20 to 29 inches; dark gray (5Y 4/1) silty clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; very dark gray (10YR 3/1) organic stains; moderately alkaline; abrupt wavy boundary.

Bg3—29 to 32 inches; dark gray (N 4/0) silty clay loam; few fine prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; slightly alkaline; abrupt wavy boundary.

Cg—32 to 60 inches; gray (5Y 5/1), stratified loam, clay loam, and silty clay loam; common coarse prominent yellowish brown (10YR 5/8) mottles; massive; firm; slightly alkaline.

The thickness of the solum ranges from 20 to 45 inches. The thickness of the mollic epipedon ranges from 10 to 18 inches. The content of organic carbon decreases irregularly with increasing depth.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly silt loam, but the range includes silty clay loam and loam.

The Bg horizon has hue of 10YR or 5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 2. It is silty clay loam, clay loam, or silt loam.

The C horizon has hue of 5Y, 2.5Y, or 10YR, value of 4 to 6, and chroma 1 to 4. It is stratified loam, clay loam, or silty clay loam.

Spinks Series

The Spinks series consists of well drained, moderately rapidly permeable soils on ground moraines, end moraines, and outwash plains. These soils formed in sandy glacial drift. Slope ranges from 0 to 70 percent.

Typical pedon of Spinks loamy fine sand, 0 to 6 percent slopes, 1,200 feet south and 2,560 feet west of the northeast corner of sec. 30, T. 15 N., R. 17 W., Hart Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy fine sand, gray (10YR 5/1) dry; weak medium granular structure; very friable; moderately acid; about 2 percent fine gravel; abrupt smooth boundary.

E1—9 to 18 inches; strong brown (7.5YR 4/6) fine sand; weak medium granular structure; very friable; slightly acid; about 3 percent fine gravel; clear wavy boundary.

E2—18 to 24 inches; brown (10YR 5/3) fine sand; single grain; loose; neutral; about 3 percent fine gravel; abrupt wavy boundary.

E and Bt—24 to 60 inches; pale brown (10YR 6/3) sand (E); single grain; loose; lamellae of dark brown (7.5YR 3/2) loamy sand (Bt) that are ¼ inch to 2 inches thick and have a total thickness of more than 6 inches; weak fine granular structure; very friable; clay bridging between sand grains; about 3 percent fine gravel; neutral.

The thickness of the solum ranges from 36 to more than 60 inches. Depth to the uppermost lamella ranges from 15 to 35 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is dominantly loamy fine sand, but the range includes fine sand and sand.

The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. It is fine sand, sand, or loamy fine sand.

The E part of the E and Bt horizon has colors and textures similar to those of the E horizon. The Bt part occurs as lamellae that are ¼ inch to 2 inches thick and have a total thickness of more than 6 inches. The lamellae have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 6. They are loamy sand or loamy fine sand.

Tekenink Series

The Tekenink series consists of well drained, moderately permeable soils on ground moraines and end moraines. These soils formed in sandy and loamy glacial till. Slope ranges from 0 to 35 percent.

Typical pedon of Tekenink loamy fine sand, in an area of Spinks-Tekenink loamy fine sands, 0 to 6 percent slopes, 1,300 feet south and 1,200 feet east of the northwest corner of sec. 33, T. 16 N., R. 17 W., Weare Township:

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy fine sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; about 3 percent fine gravel; neutral; abrupt smooth boundary.

E—9 to 15 inches; dark yellowish brown (10YR 4/4) loamy fine sand; weak medium subangular blocky structure; very friable; neutral; clear irregular boundary.

E/Bt—15 to 35 inches; about 75 percent pale brown (10YR 6/3) loamy fine sand (E); weak fine subangular blocky structure; surrounding yellowish red (5YR 4/6) sandy loam (Bt); weak medium subangular blocky structure; friable; colloid in bridges between mineral grains; about 3 percent fine gravel; slightly acid; abrupt wavy boundary.

Bt—35 to 46 inches; yellowish red (5YR 4/6) sandy loam; moderate coarse subangular blocky structure; friable; colloid in bridges between mineral grains; about 2 percent fine gravel; slightly acid; clear broken boundary.

C—46 to 60 inches; brown (7.5YR 5/4) sandy loam; massive; friable; about 5 percent fine gravel; neutral.

The thickness of the solum ranges from 35 to more than 60 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. It is dominantly loamy fine sand, but the range includes loamy sand and fine sandy loam.

The E horizon has hue 10YR, value of 4 to 7, and chroma of 2 to 4. It is loamy fine sand or loamy sand.

The E part of the E/Bt horizon has colors and textures similar to those of the E horizon. The Bt part has colors and textures similar to those of the Bt horizon.

The Bt horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam, fine sandy loam, or loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6. It is mainly sandy loam or fine sandy loam. In some pedons, however, it has pockets of loamy sand or sand.

Thetford Series

The Thetford series consists of somewhat poorly drained, moderately rapidly permeable soils on ground moraines and outwash plains. These soils formed in sandy glacial till or glacial outwash. Slope ranges from 0 to 4 percent.

Typical pedon of Thetford loamy fine sand, 0 to 4 percent slopes, 2,400 feet north and 1,100 feet west of the southeast corner of sec. 29, T. 14 N., R. 17 W., Shelby Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; about 3 percent fine gravel; neutral; abrupt smooth boundary.

E—9 to 24 inches; brown (10YR 4/3) loamy fine sand; common fine distinct light brownish gray (10YR 6/2) mottles; weak fine granular structure; very friable; about 3 percent fine gravel; neutral; clear wavy boundary.

E and Bt—24 to 54 inches; yellowish brown (10YR 5/4) sand (E); common medium distinct light brownish gray (10YR 6/2) and few fine light yellowish brown (10YR 6/4) mottles; single grain; loose; lamellae of dark brown (7.5YR 4/4) loamy sand (Bt) that are ¼ inch to 3 inches thick and have a total thickness of more than 6 inches; weak fine subangular blocky structure; very friable; clay bridging between sand grains; about 5 percent fine gravel; neutral; clear wavy boundary.

C—54 to 60 inches; brown (10YR 5/3) sand; common coarse distinct light brownish gray (10YR 6/2) mottles; single grain; loose; about 5 percent fine gravel; slightly alkaline.

The thickness of the solum ranges from 40 to 60 inches. The content of gravel ranges from 0 to 5 percent throughout the solum.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes loamy sand and fine sand.

The E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is loamy fine sand, loamy sand, or sand.

The E part of the E and Bt horizon has colors and textures similar to those of the E horizon. The Bt part occurs as lamellae that are ¼ inch to 3 inches thick and have a total thickness of more than 6 inches. The lamellae have hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 3 or 4. They are loamy sand, sandy loam, or fine sandy loam.

The C horizon has value of 5 or 6 and chroma of 1 to 3. It is sand or fine sand.

Toogood Series

The Toogood series consists of somewhat excessively drained soils on outwash plains, end moraines, and terraces. These soils formed in sandy and gravelly glacial outwash. Permeability is rapid in the upper part of the profile and very rapid in the lower part. Slope ranges from 0 to 18 percent.

Typical pedon of Toogood loamy sand, in an area of Coloma-Toogood complex, 0 to 6 percent slopes, 1,000 feet south and 1,450 feet east of the northwest corner of sec. 34, T. 14 N., R. 15 W., Newfield Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; about 3 percent fine gravel; strongly acid; abrupt smooth boundary.

Bw1—9 to 25 inches; strong brown (7.5YR 4/6) loamy sand; weak medium subangular blocky structure; very friable; about 5 percent fine gravel; moderately acid; clear wavy boundary.

Bw2—25 to 36 inches; strong brown (7.5YR 5/6) sand; single grain; loose; about 7 percent fine gravel; moderately acid; abrupt wavy boundary.

2Bt—36 to 38 inches; dark brown (7.5YR 3/4) gravelly sandy loam; weak medium subangular blocky structure; friable; about 17 percent fine and medium gravel; moderately alkaline; abrupt wavy boundary.

3C—38 to 60 inches; light yellowish brown (10YR 6/4), stratified gravelly loamy sand and sand; single grain; loose; about 20 percent fine and medium gravel; neutral.

The thickness of the solum ranges from 30 to 45 inches. The content of gravel ranges from 1 to 20 percent in the solum. The 2Bt horizon is 0 to 2 inches thick.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 2. It is dominantly loamy sand, but the range includes sand.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is sand or loamy sand.

The 2Bt horizon has hue of 7.5YR or 10YR, value of

3 or 4, and chroma of 4 to 6. It is gravelly sandy loam, loamy sand, or gravelly loamy sand.

The 3C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is gravelly sand or gravelly coarse sand.

Typic Haplaquods, Sandy

These soils are sandy, mixed, mesic Typic Haplaquods. They are very poorly drained, rapidly permeable soils on lake plains and outwash plains. They formed in sandy lacustrine or outwash material. Slope ranges from 0 to 2 percent.

Reference pedon of Typic Haplaquods, sandy, 1,000 feet south and 2,200 feet west of the northeast corner of sec. 13, T. 16 N., R. 17 W., Weare Township:

A—0 to 6 inches; black (10YR 2/1) mucky sand; weak medium granular structure; very friable; many very fine and fine roots; strongly acid; clear smooth boundary.

E—6 to 9 inches; grayish brown (10YR 5/2) sand; few distinct brown (7.5YR 5/2) mottles; weak medium granular structure; very friable; common fine roots; strongly acid; abrupt irregular boundary.

Bhs—9 to 12 inches; dark reddish brown (5YR 2/2) sand; moderate medium subangular blocky structure; friable; strongly acid; clear wavy boundary.

Bs—12 to 25 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; friable; strongly acid; gradual wavy boundary.

C—25 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; strongly acid.

The thickness of the solum ranges from 20 to 50 inches. The thickness of the organic material at the surface ranges from 2 to 10 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. In some pedons it is sand, fine sand, or loamy sand. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4.

The Bhs horizon has hue of 5YR or 7.5YR, value of 2 to 4, and chroma of 1 to 3. It is less than 30 percent weakly cemented ortstein. The Bs horizon has hue of 7.5YR, value of 3 to 5, and chroma of 3 to 6.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. In some pedons strata of loamy fine sand to coarse sand are in and below this horizon.

Typic Haplaquolls, Sandy Over Loamy

These soils are sandy over loamy, mixed, mesic Typic Haplaquolls. They are very poorly drained soils on ground moraines, flood plains, and lake plains. They formed in sandy material over loamy material. Permeability is rapid in the sandy material and moderately slow in the loamy material. Slope ranges from 0 to 2 percent.

Reference pedon of Typic Haplaquolls, sandy over loamy, 2,250 feet south and 1,850 feet east of the northwest corner of sec. 4, T. 16 N., R. 15 W., Colfax Township:

Oa—0 to 2 inches; black (10YR 2/1) muck, gray (10YR 5/1) dry; weak medium granular structure; very friable; many very fine and fine roots; neutral; abrupt smooth boundary.

A—2 to 10 inches; black (10YR 2/1) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak medium granular structure; very friable; many very fine and fine roots; slightly alkaline; clear smooth boundary.

Bg—10 to 14 inches; gray (5YR 5/2) loamy fine sand; few medium distinct yellowish red (5YR 4/6) mottles; weak medium granular structure; very friable; many fine roots; slightly alkaline; gradual wavy boundary.

Cg1—14 to 20 inches; grayish brown (10YR 5/2) loamy fine sand; few medium distinct dark yellowish brown (10YR 4/4) mottles; single grain; loose; slightly alkaline; clear wavy boundary.

2Cg2—20 to 44 inches; brown (7.5YR 5/2) sandy clay loam; massive; firm; moderately alkaline; moderate effervescence; clear wavy boundary.

2Cg3—44 to 60 inches; grayish brown (10YR 5/2) silty clay loam; massive; firm; moderately alkaline; moderate effervescence.

The thickness of the organic surface layer ranges from 0 to 5 inches. The depth to loamy deposits ranges from 20 to 35 inches.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2.

The Bg horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2. It is loamy fine sand to sand.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is loamy fine sand to coarse sand.

The 2C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 4. It is dominantly sandy clay loam, silty clay loam, silt loam, or clay loam. In some pedons, however, it has strata of fine sand, sand, or loamy sand. The strata are 1 to 3 inches thick.

Typic Udipsamments

These soils are mixed, mesic Typic Udipsamments. They are excessively drained soils on outwash plains and moraines. They formed in sandy glacial outwash. Permeability is rapid. Slope ranges from 0 to 30 percent.

Reference pedon of Typic Udipsamments, nearly level and undulating, 1,000 feet west and 600 feet north of the center of sec. 13, T. 13 N., R. 16 W., Otto Township:

Oi—0 to 1 inch; undecomposed hardwood and coniferous leaf litter.

A—1 to 3 inches; very dark gray (10YR 3/1) sand, light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; many very fine and fine roots; strongly acid; abrupt wavy boundary.

Bw1—3 to 15 inches; yellowish brown (10YR 4/6) sand; single grain; loose; strongly acid; gradual smooth boundary.

Bw2—15 to 23 inches; yellowish brown (10YR 5/6) sand; single grain; loose; strongly acid; gradual wavy boundary.

BC—23 to 36 inches; brownish yellow (10YR 6/6) sand; single grain; loose; strongly acid; gradual wavy boundary.

C—36 to 99 inches; very pale brown (10YR 7/4) sand; single grain; loose; strongly acid.

The thickness of the solum ranges from 20 to 45 inches. In some pedons the texture below the control section is coarse sand, loamy sand, or fine sand. The content of gravel ranges from 0 to 10 percent throughout the profile. Mottles and saturation of the soils can occur at a depth of 60 to 180 inches in very deep water table phases.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The BC horizon has hue of 10YR, value of 5 to 7, and chroma of 4 to 6.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 4 to 6. It is sand or coarse sand within a depth of 60 inches. In some pedons the texture is loamy sand, coarse loamy sand, or fine sand below a depth of 60 inches. Banded substratum phases have thin lamellae of loamy sand or sandy loam below a depth of 60 inches.

Formation of the Soils

The paragraphs that follow relate the factors of soil formation to the soils in Oceana County and explain the processes of soil formation.

Factors of Soil Formation

Soil forms through the interaction of five major factors—the physical, chemical, and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the processes of soil formation have acted on the parent material *(7)*.

Climate and plant and animal life are the active forces of soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material affects the kind of soil profile that forms. In extreme cases, it determines the soil profile entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the differentiation of soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The parent materials of the soils in Oceana County were deposited by glaciers or by glacial meltwater. The glaciers covered the county 10,000 to 12,000 years ago. Some of these materials have been reworked and redeposited by the subsequent action of wind and water. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Oceana County were deposited as glacial till, outwash, lacustrine material, alluvium, and organic material.

Glacial till was deposited directly by the glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Oceana County is calcareous clay, clay loam, loam, and sandy loam. Perrinton soils are an example of soils that formed in glacial till. They typically are fine textured and have a well developed subsoil.

Outwash was deposited by running water from melting glaciers. The size of the particles varies according to the speed of the stream that carried them. As the speed of the stream decreased, the coarser particles were deposited. Only the finer particles, such as very fine sand, silt, and clay, can be carried by slow moving water. Outwash deposits generally occur as layers of particles of similar size, such as loamy sand, sand, and gravel. Toogood soils are an example of soils that formed in deposits of outwash.

Lacustrine material was deposited from still, or ponded, glacial meltwater. Because the coarser fragments dropped out of the moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remained to settle out in still water. The soils in Oceana County that formed in lacustrine deposits typically are medium textured. Arkport soils are an example.

Alluvium is material recently deposited by floodwater from streams. This material varies in texture, depending on the speed of the water from which it was deposited. Sloan and Glendora are examples of soils that formed in alluvium.

Organic material occurs as deposits of plant remains. After the glaciers receded, water was left standing in depressions on the outwash plains, flood plains, moraines, and till plains. Because of the wetness, the grasses, sedges, and water-tolerant plants that grew around the edges of these depressions did not decompose quickly after they died. Eventually, the plant residue filled the depressions and decomposed to form muck. Houghton soils are an example of soils that formed in organic material.

Plant and Animal Life

Native plants are the principal organisms that have influenced soil formation in Oceana County. Microorganisms, earthworms, and human activities also have been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material in the soil depends on the kinds of plants that grew on the soil in the past. The remains of these plants accumulated on the surface, decayed, and eventually became organic matter. The roots of the plants provided channels for the downward movement of water through the soil and added organic matter as they decayed. Bacteria in the soil helped to break down the organic matter into plant nutrients.

More than 50 percent of the well drained, sandy areas in Oceana County were dominated by coniferous trees. The rest of these areas supported mixed hardwoods. Differences in natural drainage and minor variations in the parent material affected the composition of the forest species. The well drained soils, such as Claybanks, Perrinton, Remus, and Tekenink soils, were covered mainly by sugar maple, beech, and oak. The somewhat poorly drained and poorly drained soils, such as Arkona, Pipestone, Bono, and Hoytville soils, were covered by elm, ash, and soft maples.

Climate

Climate determines the kind of plant and animal life on and in the soil and the amount of water available for the weathering of minerals and for the translocation of soil material. Through its influence on soil temperature, climate also determines the rate of chemical reaction in the soil.

The climate in Oceana County is cool and humid. It is generally uniform throughout the county. In areas adjacent to Lake Michigan and in areas a few miles inland, however, the date of the first frost in fall is later than is typical in other areas and the date of the last frost in spring is earlier because the lake warms up slowly in the spring and cools slowly in the fall.

Relief

Relief affects the natural drainage of soils, the rate of erosion, the kind of plant cover, and the soil temperature. Slopes range from 0 to 85 percent in Oceana County. Runoff is most rapid on the steeper slopes. In low areas, water is temporarily ponded.

The soils in the county range from excessively drained on hilltops and ridgetops to very poorly drained in depressions. Through its effect on soil aeration, drainage partly determines the color of the soils. Water and air move freely through well drained soils and slowly through very poorly drained soils. In Perrinton and other well aerated soils, the iron and aluminum compounds are brightly colored and oxidized. Bono and other poorly aerated soils are dull gray and mottled. The Perrinton and Bono soils formed in similar kinds of parent material.

Time

Generally, a long time is needed for the development of distinct soil horizons. Differences in the length of time that the parent material has been in place are commonly reflected in the degree of profile development. Some soils form rapidly. Others form slowly. The soils in Oceana County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to the soil-forming factors long enough for the development of distinct horizons. The soils that formed in recent alluvial sediments, however, have not been in place long enough for the development of distinct horizons. Sloan soils are an example of young alluvial soils. Perrinton soils are an example of mature soils.

Processes of Soil Formation

The processes responsible for the development of soil horizons in the unconsolidated parent material are referred to as soil genesis. Several processes were involved in the development of horizons in the soils of Oceana County. These processes include the accumulation of organic matter, the leaching of lime (calcium carbonate), and the formation and translocation of silicate clay minerals. In most of the soils, more than one of these processes have been active in the development of horizons.

As organic matter accumulates at the surface of a soil, an A horizon forms. If the soil is plowed, this horizon is mixed into a plow layer, or Ap horizon. In the soils in Oceana County, the surface layer ranges from high to low in content of organic matter. Bono soils are an example of soils that have a high content of organic matter in the surface layer. Benona soils are an example of soils that have a low content of organic matter.

The leaching of carbonates and other bases has occurred in most of the soils. The leaching of bases generally precedes the translocation of silicate clay minerals. Many of the soils in Oceana County are moderately leached or strongly leached. For example, Remus soils are leached of carbonates to a depth of 59 inches, and Perrinton soils are leached to a depth of 40 inches. The difference in the depth of leaching is a result of variations in the effects of time, relief, and parent material.

Gleying, or the reduction and transfer or iron, is evident in somewhat poorly drained soils to very poorly drained soils. A gray subsoil in these soils indicates the reduction and loss of iron. Bono soils are an example of strongly gleyed soils.

The translocation of clay minerals contributes to horizon development. An eluviated, or leached, E horizon typically has platy structure and is lower in content of clay and lighter in color than the illuviated B horizon. The B horizon typically has an accumulation of clay, or clay films, in pores and on the faces of peds. Soils at this stage of formation probably were leached of carbonates and soluble salts to a considerable extent before the silicate clays were translocated. Perrinton soils are an example.

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Back slope. The steepest and principal part of many slopes. A back slope commonly is steep and descends to a foot slope.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Broad plain. An extensive area of nearly level, gently sloping, or undulating soils characterized by low relief.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Dune. A mound, ridge, or hill of loose, windblown sandy material that is either bare or covered with vegetation.

Dysic soil. An organic soil having a pH value of less than 4.5 in all layers of the control section.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Euic soil. An organic soil having a pH value of more than 4.5 in all layers of the control section.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots.

When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics.

The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Knoll. A small, low, rounded hill rising above the adjacent nearly level areas.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lamellae. In sandy soils, thin bands of more clayey material spaced a few centimeters to several inches apart.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mucky peat. See Hemic soil material.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Ridge. A long, narrow elevation of the land surface. It generally has a sharp crest and steep sides and forms an extended upland between valleys.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder slope. The uppermost inclined part of a slope. A shoulder slope is the transition zone between a back slope and the summit of an upland.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace;

land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

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Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-80 at Hart and Hesperia in Oceana County and at Montague in Muskegon County)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
HART:											
January----	29.4	15.6	22.5	49	-9	0	2.55	1.75	3.29	9	34.4
February---	31.9	15.4	23.7	51	-11	0	1.79	1.10	2.40	6	18.7
March------	41.0	23.2	32.1	67	-3	5	2.26	1.28	3.14	6	10.7
April------	55.8	34.6	45.2	79	16	63	3.25	2.08	4.31	7	2.1
May--------	68.0	44.0	56.0	86	25	234	2.63	1.49	3.63	6	.0
June-------	77.1	53.4	65.3	91	35	467	3.28	1.59	4.73	7	.0
July-------	81.4	58.1	69.8	93	42	619	2.91	1.67	4.00	6	.0
August-----	79.5	57.3	68.4	92	40	578	3.39	1.30	5.13	6	.0
September--	72.0	50.5	61.3	90	31	350	3.36	1.30	5.07	7	.0
October----	60.7	41.4	51.1	81	24	131	3.30	1.71	4.70	7	.7
November---	46.0	31.4	38.7	68	9	14	3.01	2.10	3.84	8	7.2
December---	34.3	21.2	27.8	57	-3	0	2.63	1.79	3.39	8	25.0
Yearly:											
Average---	56.4	37.2	46.8	---	---	---	---	---	---	---	---
Extreme---	---	---	---	94	-14	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,461	34.36	29.92	38.64	83	98.8
HESPERIA:											
January----	28.6	12.7	20.7	50	-14	0	2.40	1.47	3.22	7	24.3
February---	31.6	12.5	22.1	50	-16	0	1.63	.91	2.26	5	14.3
March------	41.2	21.3	31.3	69	-8	5	2.30	1.27	3.20	6	9.8
April------	56.5	32.9	44.7	81	13	61	3.34	1.95	4.57	7	2.2
May--------	69.0	42.5	55.8	88	23	228	2.70	1.52	3.75	6	.0
June-------	78.2	51.8	65.0	93	32	459	3.05	1.58	4.33	6	.0
July-------	82.1	56.1	69.1	94	39	600	2.81	1.60	3.87	6	.0
August-----	80.1	54.7	67.4	93	36	547	3.79	1.57	5.66	6	.0
September--	72.2	47.6	59.9	90	28	314	3.22	1.43	4.80	6	.0
October----	60.7	38.3	49.5	82	18	111	3.05	1.31	4.53	7	.2
November---	45.7	29.0	37.4	70	6	11	2.78	1.80	3.66	8	6.7
December---	33.4	18.6	26.0	56	-8	0	2.50	1.38	3.49	7	18.0
Yearly:											
Average---	56.6	34.8	45.7	---	---	---	---	---	---	---	---
Extreme---	---	---	---	95	-20	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,336	33.57	28.30	38.56	77	75.5

See footnote at end of table.

TABLE 1.--TEMPERATURE AND PRECIPITATION--Continued

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
MONTAGUE:											
January----	30.5	16.0	23.3	51	-13	0	2.57	1.53	3.51	9	32.0
February---	33.4	15.8	24.6	52	-12	0	1.61	.79	2.32	6	16.4
March------	42.5	23.1	32.8	68	-5	5	2.29	1.22	3.23	6	9.2
April------	56.3	33.7	45.0	78	14	55	3.37	2.06	4.55	7	1.7
May--------	68.0	42.9	55.5	85	24	215	2.57	1.37	3.62	6	.0
June-------	76.7	51.7	64.2	90	32	436	2.67	1.45	3.75	6	.0
July-------	80.4	56.5	68.5	91	39	579	2.93	1.63	4.07	5	.0
August-----	79.1	55.7	67.4	90	37	548	3.62	1.44	5.43	6	.0
September--	72.0	49.1	60.6	88	29	330	3.22	1.17	4.92	6	.0
October----	61.3	40.2	50.8	79	21	120	3.14	1.55	4.51	7	.5
November---	46.8	31.3	39.1	68	10	13	3.00	1.88	4.01	8	7.2
December---	35.4	21.6	28.5	56	-2	0	2.56	1.51	3.50	8	22.5
Yearly:											
Average---	56.9	36.5	46.7	---	---	---	---	---	---	---	---
Extreme---	---	---	---	93	-17	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,301	33.55	29.11	38.02	80	89.5

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-80 at Hart and Hesperia in Oceana County and at Montague in Muskegon County)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
HART:			
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 29	May 18	May 30
2 years in 10 later than--	Apr. 24	May 13	May 25
5 years in 10 later than--	Apr. 16	May 4	May 15
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 24	Oct. 4	Sept. 18
2 years in 10 earlier than--	Oct. 29	Oct. 10	Sept. 24
5 years in 10 earlier than--	Nov. 8	Oct. 21	Oct. 5
HESPERIA:			
Last freezing temperature in spring:			
1 year in 10 later than--	May 8	May 22	June 12
2 years in 10 later than--	May 3	May 18	June 6
5 years in 10 later than--	Apr. 23	May 9	May 26
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 8	Sept. 19	Sept. 12
2 years in 10 earlier than--	Oct. 13	Sept. 25	Sept. 16
5 years in 10 earlier than--	Oct. 24	Oct. 6	Sept. 25

TABLE 2.--FREEZE DATES IN SPRING AND FALL--Continued

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
MONTAGUE:			
Last freezing temperature in spring:			
1 year in 10 later than--	May 7	May 26	June 9
2 years in 10 later than--	May 1	May 19	June 3
5 years in 10 later than--	Apr. 21	May 7	May 23
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 12	Sept. 27	Sept. 10
2 years in 10 earlier than--	Oct. 18	Oct. 2	Sept. 16
5 years in 10 earlier than--	Oct. 29	Oct. 12	Sept. 28

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-80 at Hart and Hesperia in Oceana County and at Montague in Muskegon County)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
HART:			
9 years in 10	186	145	120
8 years in 10	193	153	128
5 years in 10	206	169	142
2 years in 10	218	184	157
1 year in 10	225	193	165
HESPERIA:			
9 years in 10	160	128	102
8 years in 10	168	135	109
5 years in 10	184	149	121
2 years in 10	199	163	134
1 year in 10	207	171	140
MONTAGUE:			
9 years in 10	169	131	100
8 years in 10	176	140	110
5 years in 10	190	157	127
2 years in 10	204	175	145
1 year in 10	212	184	154

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
10B	Perrinton loam, 2 to 6 percent slopes	3,399	1.0
10C	Perrinton loam, 6 to 12 percent slopes	758	0.2
10D	Perrinton loam, 12 to 18 percent slopes	285	0.1
10E	Perrinton loam, 18 to 35 percent slopes	1,024	0.3
11A	Ithaca loam, 0 to 3 percent slopes	1,290	0.4
12	Bono silt loam	994	0.3
13B	Marlette fine sandy loam, 2 to 6 percent slopes	1,063	0.3
13C	Marlette fine sandy loam, 6 to 12 percent slopes	142	*
13D	Marlette fine sandy loam, 12 to 18 percent slopes	63	*
14B	Capac fine sandy loam, 0 to 4 percent slopes	324	0.1
16B	Remus fine sandy loam, 1 to 6 percent slopes	1,410	0.4
16C	Remus fine sandy loam, 6 to 12 percent slopes	795	0.2
16D	Remus fine sandy loam, 12 to 18 percent slopes	278	0.1
17B	Marlette-Fern complex, 0 to 6 percent slopes	798	0.2
17C	Marlette-Fern complex, 6 to 12 percent slopes	646	0.2
17D	Marlette-Fern complex, 12 to 18 percent slopes	122	*
18B	Spinks-Gowdy loamy fine sands, 0 to 6 percent slopes	876	0.3
18C	Spinks-Gowdy loamy fine sands, 6 to 12 percent slopes	486	0.1
18D	Spinks-Gowdy loamy fine sands, 12 to 18 percent slopes	109	*
20B	Arkport-Chelsea complex, 0 to 6 percent slopes	792	0.2
20C	Arkport-Chelsea complex, 6 to 12 percent slopes	389	0.1
20D	Arkport-Chelsea complex, 12 to 18 percent slopes	199	0.1
21A	Freesoil loamy very fine sand, 0 to 3 percent slopes	1,312	0.4
22B	Gowdy loamy fine sand, 1 to 6 percent slopes	670	0.2
22C	Gowdy loamy fine sand, 6 to 12 percent slopes	191	0.1
23A	Arkona loamy fine sand, 0 to 3 percent slopes	1,479	0.4
24	Sickles loamy sand	711	0.2
25B	Gowdy-Perrinton complex, 1 to 6 percent slopes	3,971	1.1
25C	Gowdy-Perrinton complex, 6 to 12 percent slopes	976	0.3
25D	Gowdy-Perrinton complex, 12 to 18 percent slopes	122	*
25E	Gowdy-Perrinton complex, 18 to 35 percent slopes	394	0.1
26A	Arkona-Ithaca complex, 0 to 3 percent slopes	2,768	0.8
27B	Arkona-Del Rey complex, 0 to 4 percent slopes	2,733	0.8
28B	Fern loamy fine sand, 0 to 6 percent slopes	833	0.2
28C	Fern loamy fine sand, 6 to 12 percent slopes	182	0.1
28D	Fern loamy fine sand, 12 to 18 percent slopes	43	*
29A	Dixboro loamy very fine sand, 0 to 3 percent slopes	1,037	0.3
30	Lamson muck	445	0.1
35B	Alvin-Spinks complex, 0 to 6 percent slopes	1,270	0.4
35C	Alvin-Spinks complex, 6 to 12 percent slopes	694	0.2
35D	Alvin-Spinks complex, 12 to 18 percent slopes	121	*
36A	Del Rey silt loam, 0 to 3 percent slopes	409	0.1
37A	Altmar loamy fine sand, 0 to 3 percent slopes	1,363	0.4
38B	Spinks-Okee complex, 0 to 6 percent slopes	1,859	0.5
38C	Spinks-Okee complex, 6 to 12 percent slopes	856	0.2
38D	Spinks-Okee complex, 12 to 18 percent slopes	265	0.1
38E	Spinks-Okee complex, 18 to 35 percent slopes	177	0.1
40B	Coloma-Toogood complex, 0 to 6 percent slopes	1,234	0.4
40C	Coloma-Toogood complex, 6 to 12 percent slopes	130	*
40D	Coloma-Toogood complex, 12 to 18 percent slopes	162	*
41	Granby mucky loamy sand, gravelly substratum	1,652	0.5
42B	Spinks-Remus-Fern complex, 0 to 6 percent slopes	6,181	1.8
42C	Spinks-Remus-Fern complex, 6 to 12 percent slopes	4,891	1.4
42D	Spinks-Remus-Fern complex, 12 to 18 percent slopes	1,467	0.4
42E	Spinks-Remus-Fern complex, 18 to 35 percent slopes	721	0.2
43B	Spinks loamy fine sand, 0 to 6 percent slopes	8,847	2.5
43C	Spinks loamy fine sand, 6 to 12 percent slopes	2,769	0.8
43D	Spinks loamy fine sand, 12 to 18 percent slopes	1,253	0.4
43E	Spinks loamy fine sand, 18 to 35 percent slopes	722	0.2
44B	Thetford loamy fine sand, 0 to 4 percent slopes	1,131	0.3
45B	Spinks-Benona complex, 0 to 6 percent slopes	10,059	2.9

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
45C	Spinks-Benona complex, 6 to 12 percent slopes	12,109	3.5
45D	Spinks-Benona complex, 12 to 18 percent slopes	6,068	1.8
45E	Spinks-Benona complex, 18 to 35 percent slopes	2,304	0.7
45F	Spinks-Benona complex, 35 to 70 percent slopes	226	0.1
46B	Grattan sand, dark subsoil, 0 to 6 percent slopes	407	0.1
48A	Saugatuck-Jebavy complex, 0 to 3 percent slopes	5,278	1.5
49B	Grattan sand, 0 to 6 percent slopes	23,231	6.7
49B3	Grattan sand, 0 to 6 percent slopes, severely eroded	880	0.3
49C	Grattan sand, 6 to 18 percent slopes	8,219	2.4
49C3	Grattan sand, 6 to 18 percent slopes, severely eroded	381	0.1
49E	Grattan sand, 18 to 35 percent slopes	1,474	0.4
49F	Grattan sand, 35 to 70 percent slopes	866	0.3
50B	Covert sand, 0 to 6 percent slopes	13,188	3.8
51B	Pipestone fine sand, 0 to 4 percent slopes	8,002	2.3
52	Granby sand	9,383	2.7
53B	Grattan sand, loamy substratum, 0 to 6 percent slopes	1,364	0.4
53C	Grattan sand, loamy substratum, 6 to 12 percent slopes	368	0.1
56B	Benona sand, deep banded, 0 to 6 percent slopes	2,913	0.8
56C	Benona sand, deep banded, 6 to 18 percent slopes	893	0.3
56E	Benona sand, deep banded, 18 to 35 percent slopes	559	0.2
57C	Nordhouse fine sand, 3 to 18 percent slopes	351	0.1
57F	Nordhouse fine sand, 18 to 75 percent slopes	1,237	0.4
58	Kingsville mucky sand	1,188	0.3
59B	Benona sand, 0 to 6 percent slopes	32,088	9.3
59C	Benona sand, 6 to 18 percent slopes	15,024	4.3
59E	Benona sand, 18 to 35 percent slopes	4,131	1.2
60B	Coloma sand, 0 to 6 percent slopes	3,045	0.9
60C	Coloma sand, 6 to 18 percent slopes	4,311	1.2
60E	Coloma sand, 18 to 35 percent slopes	414	0.1
61B	Epworth fine sand, 0 to 6 percent slopes	3,472	1.0
61C	Epworth fine sand, 6 to 18 percent slopes	1,612	0.5
61E	Epworth fine sand, 18 to 35 percent slopes	378	0.1
62B	Plainfield sand, 0 to 6 percent slopes	7,665	2.2
62C	Plainfield sand, 6 to 18 percent slopes	253	0.1
65	Sloan silt loam, frequently flooded	738	0.2
67	Cohoctah fine sandy loam, occasionally flooded	577	0.2
69	Algansee loamy fine sand, occasionally flooded	182	0.1
70	Glendora mucky loamy fine sand, frequently flooded	3,797	1.1
71	Houghton and Carlisle soils	8,010	2.3
72	Adrian muck	6,015	1.7
73	Palms muck	507	0.1
75	Martisco muck	434	0.1
77	Napoleon muck	1,325	0.4
83	Histosols and Aquents, ponded	874	0.3
84F	Dune land-Quartzipsamments-Psammaquents complex, nearly level to steep	299	0.1
85F	Udorthents-Quartzipsamments complex, very steep	179	0.1
86F	Dune land-Quartzipsamments complex, rolling to very steep	1,732	0.5
87	Beaches	245	0.1
88A	Udipsamments, nearly level	243	0.1
89A	Udorthents, nearly level	14	*
91	Pits, sand and gravel	652	0.2
92B	Chelsea fine sand, 0 to 6 percent slopes	969	0.3
92C	Chelsea fine sand, 6 to 12 percent slopes	376	0.1
96B	Spinks-Tekenink loamy fine sands, 0 to 6 percent slopes	3,028	0.9
96C	Spinks-Tekenink loamy fine sands, 6 to 12 percent slopes	2,268	0.7
96D	Spinks-Tekenink loamy fine sands, 12 to 18 percent slopes	544	0.2
96E	Spinks-Tekenink loamy fine sands, 18 to 35 percent slopes	321	0.1
97	Kerston and Carlisle mucks, frequently flooded	3,473	1.0
98B	Spinks-Scalley complex, 0 to 6 percent slopes	415	0.1
98C	Spinks-Scalley complex, 6 to 12 percent slopes	473	0.1
98D	Spinks-Scalley complex, 12 to 18 percent slopes	143	*

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
99B	Nappanee-Hoytville silt loams, 0 to 4 percent slopes	1,180	0.3
100B	Nappanee silt loam, 0 to 4 percent slopes	521	0.2
101B	Claybanks silt loam, 1 to 6 percent slopes	1,003	0.3
101C	Claybanks silt loam, 6 to 12 percent slopes	142	*
210B	Typic Udipsamments, nearly level and undulating	5,853	1.7
210C	Typic Udipsamments, rolling	553	0.2
210D	Typic Udipsamments, hilly	2,002	0.6
211B	Typic Udipsamments, banded substratum, nearly level and undulating	322	0.1
211C	Typic Udipsamments, banded substratum, rolling	81	*
212B	Typic Udipsamments, very deep water table, nearly level and undulating	1,047	0.3
213B	Argic Udipsamments, nearly level and undulating	1,153	0.3
213C	Argic Udipsamments, rolling	72	*
213D	Argic Udipsamments, hilly	55	*
220B	Entic Haplorthods, sandy, nearly level and undulating	4,364	1.3
220C	Entic Haplorthods, sandy, rolling	1,014	0.3
220D	Entic Haplorthods, sandy, hilly	187	0.1
220E	Entic Haplorthods, sandy, steep and very steep	73	*
221B	Entic Haplorthods, sandy, coarse-loamy banded substratum, nearly level and undulating	2,129	0.6
221C	Entic Haplorthods, sandy, coarse-loamy banded substratum, rolling	2,269	0.7
221D	Entic Haplorthods, sandy, coarse-loamy banded substratum, hilly	637	0.2
221E	Entic Haplorthods, sandy, coarse-loamy banded substratum, steep and very steep	310	0.1
222B	Entic Haplorthods, sandy, very deep water table, nearly level and undulating	5,125	1.5
222C	Entic Haplorthods, sandy, very deep water table, rolling	129	*
223B	Entic Haplorthods, sandy, fine-loamy banded substratum, nearly level and undulating	630	0.2
223C	Entic Haplorthods, sandy, fine-loamy banded substratum, rolling	2,907	0.8
223D	Entic Haplorthods, sandy, fine-loamy banded substratum, hilly	1,859	0.5
223E	Entic Haplorthods, sandy, fine-loamy banded substratum, steep and very steep	156	*
224B	Entic Haplorthods, sandy, deep water table, nearly level and undulating	718	0.2
225B	Entic Haplorthods, sandy, loamy substratum, nearly level and undulating	345	0.1
225C	Entic Haplorthods, sandy, loamy substratum, rolling	31	*
225D	Entic Haplorthods, sandy, loamy substratum, hilly	34	*
230B	Entic Haplorthods, sandy, calcareous substratum, nearly level and undulating	352	0.1
230C	Entic Haplorthods, sandy, calcareous substratum, rolling	483	0.1
230D	Entic Haplorthods, sandy, calcareous substratum, hilly	84	*
230E	Entic Haplorthods, sandy, calcareous substratum, steep and very steep	89	*
231B	Entic Haplorthods, sandy-Alfic Haplorthods, sandy over loamy complex, nearly level and undulating	15	*
233B	Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, nearly level and undulating	217	0.1
233C	Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, rolling	1,617	0.5
233D	Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, hilly	764	0.2
233E	Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, steep and very steep	148	*
235B	Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, nearly level and undulating	102	*
235C	Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, rolling	119	*
240C	Entic Haplorthods, sandy, dark subsoil, rolling	17	*
241B	Entic Haplorthods, sandy, dark subsoil, banded substratum, nearly level and undulating	211	0.1
245B	Entic Haplorthods, sandy, dark subsoil, loamy substratum, nearly level and undulating	57	*
245C	Entic Haplorthods, sandy, dark subsoil, loamy substratum, rolling	127	*
245D	Entic Haplorthods, sandy, dark subsoil, loamy substratum, hilly	84	*
250	Mollic Psammaquents-Aquic Udipsamments-Medisaprists, euic complex, occasionally flooded	1,684	0.5
262A	Aeric Haplaquods, sandy, ortstein, nearly level	473	0.1
263A	Aquic Udipsamments, nearly level	96	*
272	Typic Haplaquods, sandy	324	0.1
273	Mollic Psammaquents	1,588	0.5
274	Typic Haplaquolls, sandy over loamy	2,093	0.6

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
280	Aquents and Histosols, ponded	421	0.1
281	Medisaprists, dysic	208	0.1
282	Medisaprists, euic	2,431	0.7
	Water areas less than 40 acres in size	2,001	0.6
	Total	349,163	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
10B	Perrinton loam, 2 to 6 percent slopes
11A	Ithaca loam, 0 to 3 percent slopes (where drained)
12	Bono silt loam (where drained)
13B	Marlette fine sandy loam, 2 to 6 percent slopes
14B	Capac fine sandy loam, 0 to 4 percent slopes (where drained)
16B	Remus fine sandy loam, 1 to 6 percent slopes
17B	Marlette-Fern complex, 0 to 6 percent slopes
20B	Arkport-Chelsea complex, 0 to 6 percent slopes
21A	Freesoil loamy very fine sand, 0 to 3 percent slopes (where drained)
22B	Gowdy loamy fine sand, 1 to 6 percent slopes
25B	Gowdy-Perrinton complex, 1 to 6 percent slopes
29A	Dixboro loamy very fine sand, 0 to 3 percent slopes (where drained)
30	Lamson muck (where drained)
35B	Alvin-Spinks complex, 0 to 6 percent slopes
36A	Del Rey silt loam, 0 to 3 percent slopes (where drained)
65	Sloan silt loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
67	Cohoctah fine sandy loam, occasionally flooded (where drained)
99B	Nappanee-Hoytville silt loams, 0 to 4 percent slopes (where drained)
100B	Nappanee silt loam, 0 to 4 percent slopes (where drained)
101B	Claybanks silt loam, 1 to 6 percent slopes

TABLE 6.--YIELDS PER ACRE OF CROPS

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. Only those soils that are commonly used for crops are listed)

Soil name and map symbol	Corn		Corn silage		Winter wheat		Oats		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Tons	Tons	Bu	Bu	Bu	Bu	Tons	Tons
10B Perrinton	110	---	18	---	55	---	85	---	5.0	---
10C Perrinton	95	---	16	---	45	---	80	---	4.5	---
10D Perrinton	80	---	14	---	38	---	70	---	3.6	---
11A Ithaca	105	---	16	---	46	---	85	---	4.0	---
12 Bono	120	---	---	---	42	---	80	---	5.0	---
13B Marlette	120	150	19	27	60	---	95	---	4.8	---
13C Marlette	110	150	15	25	56	---	90	---	4.5	---
13D Marlette	85	---	13	20	48	---	65	---	3.8	---
14B Capac	110	155	17	26	62	---	95	---	5.5	6.8
16B Remus	95	155	16	26	40	60	80	---	3.8	7.0
16C Remus	90	145	15	24	37	57	75	---	3.6	6.5
16D Remus	85	---	12	---	34	---	65	---	3.4	---
17B Marlette-Fern	113	---	18	---	51	---	88	---	4.4	---
17C Marlette-Fern	103	---	16	---	47	---	82	---	4.1	---
17D Marlette-Fern	80	---	13	---	45	---	65	---	3.8	---
18B Spinks-Gowdy	77	---	13	---	---	---	60	---	---	---
18C Spinks-Gowdy	71	---	12	---	---	---	55	---	---	---
18D Spinks-Gowdy	---	---	---	---	24	---	50	---	---	---

TABLE 6.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn		Corn silage		Winter wheat		Oats		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Tons	Tons	Bu	Bu	Bu	Bu	Tons	Tons
20B Arkport-Chelsea	88	---	21	---	50	---	64	---	5.0	---
20C Arkport-Chelsea	85	---	18	---	50	---	64	---	4.5	---
20D Arkport-Chelsea	70	---	14	---	45	---	60	---	4.0	---
21A Freesoil	115	---	19	---	50	---	95	---	4.8	---
22B Gowdy	80	---	13	---	---	---	60	---	4.6	---
22C Gowdy	75	---	12	---	---	---	55	---	4.4	---
23A Arkona	100	150	16	27	45	---	80	---	5.0	---
25B Gowdy-Perrinton	94	---	---	15	---	---	71	---	4.8	---
25C Gowdy-Perrinton	84	---	14	---	---	---	66	---	4.4	---
25D Gowdy-Perrinton	75	---	11	---	35	---	55	---	4.0	---
26A Arkona-Ithaca	109	148	18	26	50	---	85	---	5.0	---
27B Arkona-Del Rey	106	---	16	---	47	---	74	---	5.5	---
28B Fern	105	---	18	---	40	---	80	---	4.0	---
28C Fern	95	---	16	---	36	---	72	---	3.6	---
28D Fern	80	---	12	---	30	---	50	---	3.2	---
29A Dixboro	115	---	19	---	50	---	95	---	4.5	---
30 Lamson	75	---	15	---	---	---	50	---	4.5	---
35B Alvin-Spinks	87	---	---	---	39	---	---	---	5.0	---
35C Alvin-Spinks	80	---	---	---	38	---	---	---	4.8	---
35D Alvin-Spinks	---	---	---	---	33	---	---	---	4.5	---

TABLE 6.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn		Corn silage		Winter wheat		Oats		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Tons	Tons	Bu	Bu	Bu	Bu	Tons	Tons
36A Del Rey	115	---	---	---	49	---	69	---	5.5	---
37A Altmar	65	---	12	---	30	---	60	---	3.5	---
38B Spinks-Okee	74	---	12	---	---	---	62	---	4.4	---
38C Spinks-Okee	67	---	12	---	---	---	55	---	3.8	---
38D Spinks-Okee	---	---	---	---	---	---	49	---	3.5	---
40B Coloma-Toogood	50	---	9	---	---	---	45	---	3.8	---
40C Coloma-Toogood	---	---	---	---	---	---	40	---	2.3	---
40D Coloma-Toogood	---	---	---	---	---	---	---	---	2.0	---
42B Spinks-Remus-Fern	89	160	15	25	36	---	72	---	3.9	---
42C Spinks-Remus-Fern	86	150	14	23	32	---	67	---	3.6	---
42D Spinks-Remus-Fern	---	---	---	---	24	---	---	---	3.0	---
43B Spinks	75	165	13	24	30	---	60	---	4.2	---
43C Spinks	68	155	12	23	30	---	55	---	3.6	---
43D Spinks	---	---	---	---	24	---	50	---	3.0	---
44B Thetford	85	148	14	22	35	---	65	---	3.8	---
45B Spinks-Benona	66	---	12	---	30	---	55	---	3.6	---
45C Spinks-Benona	59	---	11	---	30	---	50	---	3.4	---
45D Spinks-Benona	---	---	---	---	20	---	45	---	3.0	---
48A Saugatuck-Jebavy	55	---	---	---	---	---	40	---	---	---

TABLE 6.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn		Corn silage		Winter wheat		Oats		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Tons	Tons	Bu	Bu	Bu	Bu	Tons	Tons
49B Grattan	---	---	---	---	---	---	---	---	2.0	---
50B Covert	80	---	13	---	40	---	60	---	3.5	---
51B Pipestone	65	130	12	22	30	45	60	---	3.5	5.5
52 Granby	80	---	14	---	40	---	60	---	---	---
53B, 53C Grattan	---	---	---	---	---	---	---	---	2.0	---
56B Benona	55	---	11	---	---	---	---	---	3.0	---
56C Benona	---	---	---	---	---	---	---	---	2.5	---
59B Benona	55	---	11	---	---	---	---	---	3.0	---
59C Benona	---	---	---	---	---	---	---	---	2.5	---
60B Coloma	45	170	---	---	---	---	45	---	3.5	---
60C Coloma	---	---	---	---	---	---	---	---	3.0	---
92B Chelsea	68	---	---	---	---	---	41	---	3.0	---
92C Chelsea	---	---	---	---	---	---	---	---	2.8	---
96B Spinks-Tekenink	86	---	15	---	35	---	69	---	4.0	---
96C Spinks-Tekenink	78	---	14	---	33	---	62	---	3.6	---
96D Spinks-Tekenink	---	---	---	---	28	---	53	---	3.1	---
98B Spinks-Scalley	94	---	15	---	42	---	72	---	4.5	---
98C Spinks-Scalley	88	---	13	---	40	---	64	---	4.0	---
98D Spinks-Scalley	---	---	---	---	33	---	60	---	3.4	---
99B Nappanee-Hoytville	120	---	---	---	52	---	---	---	5.5	---

TABLE 6.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn		Corn silage		Winter wheat		Oats		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Tons	Tons	Bu	Bu	Bu	Bu	Tons	Tons
100B-------------------------- Nappanee	110	---	17	---	52	---	85	---	5.5	---
101B-------------------------- Claybanks	110	---	18	---	55	---	85	---	5.0	---
101C-------------------------- Claybanks	95	---	16	---	45	---	80	---	4.5	---

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	11,792	10,346	1,446	---	---
III	82,612	35,774	11,782	35,056	---
IV	103,189	15,475	24,026	63,688	---
V	28,405	---	28,405	---	---
VI	81,607	1,264	5,867	74,476	---
VII	29,620	6,037	---	23,583	---
VIII	---	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
10B, 10C, 10D--- Perrinton	4A	Slight	Slight	Slight	Slight	Northern red oak----	69	64	Northern red oak, white spruce, eastern white pine.
						Sugar maple---------	---	---	
						Red maple-----------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
10E------------- Perrinton	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	69	64	Northern red oak, white spruce, eastern white pine.
						Sugar maple---------	---	---	
						Red maple-----------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
11A------------- Ithaca	4W	Slight	Severe	Slight	Slight	Northern red oak----	65	59	White spruce, eastern white pine.
						Sugar maple---------	---	---	
						American basswood---	---	---	
						White ash-----------	---	---	
						Red maple-----------	---	---	
12-------------- Bono	4W	Slight	Severe	Severe	Severe	Pin oak-------------	80	80	---
						Swamp white oak-----	---	---	
						Green ash-----------	---	---	
						Red maple-----------	---	---	
						Eastern cottonwood--	---	---	
						Black cherry--------	---	---	
13B, 13C, 13D--- Marlette	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	Black walnut, eastern white pine, red pine, white spruce.
						Northern red oak----	69	64	
						White ash-----------	---	---	
						Black walnut--------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
						White oak-----------	---	---	
						Black oak-----------	---	---	
14B------------- Capac	4W	Slight	Moderate	Slight	Slight	Northern red oak----	65	59	Northern red oak, eastern white pine, white spruce.
						American basswood---	---	---	
						Pin oak-------------	---	---	
						White ash-----------	---	---	
						Red maple-----------	---	---	
						Bitternut hickory---	---	---	
						Sugar maple---------	---	---	
						Black cherry--------	---	---	
						American beech------	---	---	
16B, 16C, 16D--- Remus	3A	Slight	Slight	Slight	Slight	Sugar maple---------	61	38	White spruce, eastern white pine, red pine.
						Northern red oak----	---	---	
						American basswood---	---	---	
						Eastern hemlock-----	---	---	
						Quaking aspen-------	---	---	
						White ash-----------	---	---	
						White oak-----------	---	---	
						Red maple-----------	---	---	
						Black cherry--------	---	---	
						American beech------	---	---	
						Paper birch---------	---	---	
						Bigtooth aspen------	74	86	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
17B**, 17C**, 17D**:									
Marlette	3A	Slight	Slight	Slight	Slight	Sugar maple	65	40	Black walnut, eastern white pine, red pine, white spruce.
						Northern red oak	69	64	
						White ash	---	---	
						Black walnut	---	---	
						American basswood	---	---	
						Black cherry	---	---	
						White oak	---	---	
						Black oak	---	---	
Fern	4S	Slight	Moderate	Moderate	Slight	Northern red oak	66	60	White spruce, eastern white pine, red pine.
						Red maple	---	---	
						Sugar maple	---	---	
						American basswood	---	---	
						Black cherry	---	---	
18B**, 18C**, 18D**:									
Spinks	4A	Slight	Slight	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
Gowdy	3A	Slight	Slight	Slight	Slight	Black oak	55	42	Red pine, eastern white pine, Norway spruce.
						Red pine	---	---	
						Eastern white pine	---	---	
						Northern red oak	---	---	
20B**, 20C**, 20D**:									
Arkport	3A	Slight	Slight	Slight	Slight	Sugar maple	70	43	Norway spruce, red pine, eastern white pine.
						Red pine	85	169	
						Eastern white pine	85	196	
Chelsea	5S	Slight	Slight	Moderate	Slight	White oak	70	65	Eastern white pine, red pine, jack pine.
						Red pine	72	134	
						Eastern white pine	83	190	
						Jack pine	70	128	
						Quaking aspen	72	84	
						Northern red oak	70	66	
21A Freesoil	3W	Slight	Severe	Moderate	Moderate	Red maple	67	41	Eastern white pine, jack pine, white spruce.
						Paper birch	---	---	
						Quaking aspen	---	---	
						Eastern white pine	---	---	
22B, 22C Gowdy	3A	Slight	Slight	Slight	Slight	Black oak	55	42	Red pine, eastern white pine, Norway spruce.
						Red pine	---	---	
						Eastern white pine	---	---	
						Northern red oak	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
23A Arkona	2W	Slight	Moderate	Slight	Slight	Red maple	56	36	White spruce, Norway spruce, eastern white pine, Carolina poplar.
						Quaking aspen	---	---	
						Paper birch	---	---	
						Eastern cottonwood	91	105	
						Swamp white oak	---	---	
						Northern red oak	---	---	
						Sugar maple	---	---	
24 Sickles	5W	Slight	Severe	Severe	Severe	Quaking aspen	61	66	White spruce, eastern white pine.
						White ash	---	---	
						Eastern cottonwood	---	---	
						American basswood	---	---	
						Red maple	---	---	
						Swamp white oak	---	---	
25B**, 25C**, 25D**:									
Gowdy	3A	Slight	Slight	Slight	Slight	Black oak	55	42	Red pine, eastern white pine, Norway spruce.
						Red pine	---	---	
						Eastern white pine	---	---	
						Northern red oak	---	---	
Perrinton	4A	Slight	Slight	Slight	Slight	Northern red oak	69	64	Northern red oak, white spruce, eastern white pine.
						Sugar maple	---	---	
						Red maple	---	---	
						White ash	---	---	
						American basswood	---	---	
25E**:									
Gowdy	3R	Moderate	Moderate	Slight	Slight	Black oak	55	42	Red pine, eastern white pine, Norway spruce.
						Red pine	---	---	
						Eastern white pine	---	---	
						Northern red oak	---	---	
Perrinton	4R	Moderate	Moderate	Slight	Slight	Northern red oak	69	64	Northern red oak, white spruce, eastern white pine.
						Sugar maple	---	---	
						Red maple	---	---	
						White ash	---	---	
						American basswood	---	---	
26A**:									
Arkona	2W	Slight	Moderate	Slight	Slight	Red maple	56	36	White spruce, Norway spruce, eastern white pine, Carolina poplar.
						Quaking aspen	---	---	
						Paper birch	---	---	
						Eastern cottonwood	91	105	
						Swamp white oak	---	---	
						Northern red oak	---	---	
						Sugar maple	---	---	
Ithaca	4W	Slight	Severe	Slight	Slight	Northern red oak	65	59	White spruce, northern whitecedar, eastern white pine.
						Sugar maple	---	---	
						American basswood	---	---	
						White ash	---	---	
						Northern pin oak	---	---	
						Shagbark hickory	---	---	
						Red maple	---	---	
						Bitternut hickory	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
27B**:									
Arkona	2W	Slight	Moderate	Slight	Slight	Red maple	56	36	White spruce, Norway spruce, eastern white pine, Carolina poplar.
						Quaking aspen	---	---	
						Paper birch	---	---	
						Eastern cottonwood	91	105	
						Swamp white oak	---	---	
						Northern red oak	---	---	
						Sugar maple	---	---	
Del Rey	3C	Slight	Moderate	Severe	Severe	Northern red oak	56	44	Northern red oak, eastern cottonwood, northern whitecedar, white spruce, eastern white pine.
						White ash	56	44	
						Red maple	56	36	
						White oak	56	44	
						American basswood	56	44	
28B, 28C, 28D Fern	4S	Slight	Moderate	Moderate	Slight	Northern red oak	66	60	White spruce, eastern white pine, red pine.
						Red maple	---	---	
						Sugar maple	---	---	
						American basswood	---	---	
						Black cherry	---	---	
29A Dixboro	4W	Slight	Moderate	Slight	Slight	Northern red oak	65	59	Eastern white pine, white spruce, northern red oak.
						White oak	---	---	
						Pin oak	---	---	
						Black oak	---	---	
						Shagbark hickory	---	---	
						Bitternut hickory	---	---	
						American basswood	---	---	
						Red maple	---	---	
30 Lamson	8W	Slight	Severe	Severe	Severe	Eastern white pine	65	136	Northern whitecedar, eastern white pine.
						Red maple	65	40	
						Pin oak	60	51	
						Swamp white oak	---	---	
35B**, 35C**, 35D**:									
Alvin	5A	Slight	Slight	Slight	Slight	Northern red oak	70	66	Eastern white pine, black walnut, white oak, green ash, sugar maple.
						White oak	70	66	
						Black walnut	---	---	
Spinks	4A	Slight	Slight	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

		Management concerns				Potential productivity			
Soil name and map symbol	Ordination symbol	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	Trees to plant
36A Del Rey	3C	Slight	Moderate	Severe	Severe	Northern red oak	56	44	Northern red oak, eastern cottonwood, northern whitecedar, white spruce, eastern white pine.
						White ash	56	44	
						Red maple	56	36	
						White oak	56	44	
						American basswood	56	44	
37A Altmar	3W	Slight	Severe	Slight	Slight	Red maple	65	40	Northern red oak, Norway spruce, white spruce, eastern white pine.
						Northern red oak	---	---	
						Bigtooth aspen	---	---	
						White ash	---	---	
						American elm	---	---	
38B**, 38C**, 38D**:									
Spinks	4A	Slight	Slight	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
Okee	2A	Slight	Slight	Slight	Slight	Northern pin oak	45	27	Red pine, jack pine.
						Black oak	---	---	
38E**:									
Spinks	4R	Moderate	Moderate	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
Okee	2R	Moderate	Moderate	Slight	Slight	Northern pin oak	45	47	Red pine, jack pine.
						Black oak	---	---	
40B**, 40C**, 40D**:									
Coloma	2S	Slight	Moderate	Moderate	Slight	Northern pin oak	49	32	Red pine, eastern white pine, jack pine.
						Jack pine	---	---	
						Eastern white pine	---	---	
						Black oak	---	---	
Toogood	6A	Slight	Slight	Slight	Slight	Red pine	55	88	Red pine, eastern white pine, jack pine.
						White oak	---	---	
						Northern red oak	---	---	
						Quaking aspen	---	---	
41 Granby	2W	Slight	Severe	Severe	Severe	Silver maple	82	36	---
						Red maple	68	42	
						American basswood	---	---	
						White ash	---	---	
						Quaking aspen	---	---	
						Eastern cottonwood	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
42B**, 42C**, 42D**:									
Spinks	4A	Slight	Slight	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
Remus	3A	Slight	Slight	Slight	Slight	Sugar maple	61	38	White spruce, eastern white pine, red pine.
						Northern red oak	---	---	
						American basswood	---	---	
						Eastern hemlock	---	---	
						Quaking aspen	---	---	
						White ash	---	---	
						White oak	---	---	
						Red maple	---	---	
						Black cherry	---	---	
						American beech	---	---	
						Paper birch	---	---	
						Bigtooth aspen	74	86	
Fern	4S	Slight	Moderate	Moderate	Slight	Northern red oak	66	60	White spruce, eastern white pine, red pine.
						Red maple	---	---	
						Sugar maple	---	---	
						American basswood	---	---	
						Black cherry	---	---	
42E**:									
Spinks	4R	Moderate	Moderate	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
Remus	3R	Moderate	Moderate	Slight	Slight	Sugar maple	61	38	White spruce, eastern white pine, red pine.
						Northern red oak	---	---	
						American basswood	---	---	
						Eastern hemlock	---	---	
						Quaking aspen	---	---	
						White ash	---	---	
						White oak	---	---	
						Red maple	---	---	
						Black cherry	---	---	
						American beech	---	---	
						Paper birch	---	---	
						Bigtooth aspen	74	86	
Fern	4R	Moderate	Moderate	Moderate	Slight	Northern red oak	66	60	White spruce, eastern white pine, red pine.
						Red maple	---	---	
						Sugar maple	---	---	
						American basswood	---	---	
						Black cherry	---	---	
43B, 43C, 43D Spinks	4A	Slight	Slight	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
43E------------ Spinks	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
44B------------ Thetford	3W	Slight	Moderate	Slight	Slight	Red maple-----------	65	40	White spruce, eastern white pine.
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern cottonwood--	---	---	
						Northern red oak----	---	---	
						Swamp white oak-----	---	---	
						Bitternut hickory---	---	---	
45B**, 45C**, 45D**:									
Spinks--------	4A	Slight	Slight	Slight	Slight	Northern red oak----	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
Benona--------	4S	Slight	Moderate	Moderate	Slight	Northern red oak----	67	61	Red pine, eastern white pine, jack pine.
						American beech------	---	---	
						Black cherry--------	---	---	
						Hemlock-------------	---	---	
						Quaking aspen-------	---	---	
						Red maple-----------	---	---	
						Red pine------------	---	---	
45E**:									
Spinks---------	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
Benona---------	4R	Moderate	Moderate	Moderate	Slight	Northern red oak----	67	61	Red pine, eastern white pine, jack pine.
						American beech------	---	---	
						Black cherry--------	---	---	
						Hemlock-------------	---	---	
						Quaking aspen-------	---	---	
						Red maple-----------	---	---	
						Red pine------------	---	---	
45F**:									
Spinks---------	4R	Severe	Severe	Slight	Slight	Northern red oak----	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
Benona---------	4R	Severe	Severe	Moderate	Slight	Northern red oak----	67	61	Red pine, eastern white pine, jack pine.
						American beech------	---	---	
						Black cherry--------	---	---	
						Hemlock-------------	---	---	
						Quaking aspen-------	---	---	
						Red maple-----------	---	---	
						Red pine------------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
46B------------ Grattan	3S	Slight	Moderate	Moderate	Slight	Sugar maple---------	70	43	Red pine, eastern white pine.
						Northern red oak----	---	---	
48A**:									
Saugatuck------	2W	Slight	Severe	Moderate	Severe	Red maple-----------	45	32	Eastern white pine, white spruce.
						Eastern cottonwood--	---	---	
						Black spruce--------	---	---	
						White ash-----------	---	---	
						Pin oak-------------	---	---	
						Paper birch---------	56	59	
Jebavy---------	2W	Slight	Severe	Severe	Severe	Red maple-----------	57	36	Jack pine, eastern white pine, white spruce.
						Quaking aspen-------	---	---	
						Jack pine-----------	---	---	
						Eastern hemlock-----	---	---	
						Eastern white pine--	66	139	
49B, 49B3, 49C, 49C3----------- Grattan	9S	Slight	Moderate	Moderate	Slight	Eastern white pine--	62	127	Eastern white pine, red pine.
						Quaking aspen-------	---	---	
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Sugar maple---------	59	37	
49E------------ Grattan	9R	Moderate	Moderate	Moderate	Slight	Eastern white pine--	62	127	Eastern white pine, red pine.
						Quaking aspen-------	---	---	
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Sugar maple---------	59	37	
49F------------ Grattan	9R	Severe	Severe	Moderate	Slight	Eastern white pine--	62	127	Eastern white pine, red pine.
						Quaking aspen-------	---	---	
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Sugar maple---------	59	37	
50B------------ Covert	4S	Slight	Moderate	Moderate	Slight	Northern red oak----	67	61	Eastern white pine, red pine.
						Red maple-----------	66	41	
						Black cherry--------	---	---	
						Eastern cottonwood--	---	---	
						American basswood---	---	---	
						White oak-----------	---	---	
						Quaking aspen-------	---	---	
						American beech------	---	---	
						Eastern white pine--	---	---	
51B------------ Pipestone	3W	Slight	Severe	Moderate	Moderate	Red maple-----------	65	40	Eastern white pine, white spruce.
						White ash-----------	---	---	
						Eastern cottonwood--	---	---	
						Bitternut hickory---	---	---	
						Eastern white pine--	64	133	
						American basswood---	56	44	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
52	2W	Slight	Severe	Severe	Severe	Silver maple	82	36	---
Granby						Red maple	68	42	
						American basswood	---	---	
						White ash	---	---	
						Quaking aspen	---	---	
						Eastern cottonwood	---	---	
53B, 53C	9S	Slight	Moderate	Moderate	Slight	Eastern white pine	62	127	Eastern white pine, red pine.
Grattan						Quaking aspen	---	---	
						White oak	---	---	
56B, 56C	3S	Slight	Moderate	Moderate	Slight	Sugar maple	61	38	Red pine, eastern white pine, jack pine, Austrian pine.
Benona						American beech	---	---	
						Northern red oak	67	61	
						Black cherry	---	---	
						Quaking aspen	---	---	
						Red pine	---	---	
						Red maple	---	---	
56E	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	61	38	Red pine, eastern white pine, jack pine, Austrian pine.
Benona						American beech	---	---	
						Northern red oak	67	61	
						Black cherry	---	---	
						Quaking aspen	---	---	
						Red pine	---	---	
						Red maple	---	---	
57C	4S	Slight	Moderate	Moderate	Slight	Northern red oak	67	61	Red pine, eastern white pine.
Nordhouse						Red maple	---	---	
						American beech	---	---	
						Paper birch	---	---	
						Eastern white pine	---	---	
						Eastern hemlock	---	---	
57F	4R	Severe	Severe	Moderate	Slight	Northern red oak	67	61	Red pine, eastern white pine.
Nordhouse						Red maple	---	---	
						American beech	---	---	
						Paper birch	---	---	
						Eastern white pine	---	---	
						Eastern hemlock	---	---	
58	5W	Slight	Severe	Severe	Severe	Bigtooth aspen	67	76	---
Kingsville						Red maple	65	40	
						Quaking aspen	67	76	
						Swamp white oak	63	56	
						Silver maple	---	---	
						White ash	---	---	
						Green ash	---	---	
59B, 59C	4S	Slight	Moderate	Moderate	Slight	Northern red oak	67	61	Red pine, eastern white pine, jack pine.
Benona						American beech	---	---	
						Black cherry	---	---	
						Hemlock	---	---	
						Quaking aspen	---	---	
						Red maple	---	---	
						Red pine	---	---	
						Sugar maple	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
59E Benona	4R	Moderate	Moderate	Moderate	Slight	Northern red oak	67	61	Red pine, eastern white pine, jack pine.
						American beech	---	---	
						Black cherry	---	---	
						Hemlock	---	---	
						Quaking aspen	---	---	
						Red maple	---	---	
						Red pine	---	---	
						Sugar maple	---	---	
60B, 60C Coloma	2S	Slight	Moderate	Moderate	Slight	Northern pin oak	49	32	Red pine, eastern white pine, jack pine.
						Jack pine	---	---	
						Eastern white pine	---	---	
						Black oak	---	---	
60E Coloma	2R	Moderate	Moderate	Moderate	Slight	Northern pin oak	49	32	Red pine, eastern white pine, jack pine.
						Jack pine	---	---	
						Eastern white pine	---	---	
						Black oak	---	---	
61B, 61C Epworth	4S	Slight	Moderate	Moderate	Slight	Northern red oak	67	61	Red pine, jack pine.
						White oak	---	---	
						Red maple	---	---	
61E Epworth	4R	Moderate	Moderate	Moderate	Slight	Northern red oak	67	61	Red pine, jack pine.
						White oak	---	---	
						Red maple	---	---	
62B, 62C Plainfield	8S	Slight	Moderate	Moderate	Slight	Eastern white pine	58	115	Red pine, eastern white pine, jack pine.
						Red pine	55	88	
						Jack pine	49	52	
65 Sloan	3W	Slight	Severe	Moderate	Moderate	Red maple	66	41	---
						Swamp white oak	---	---	
						White ash	66	60	
						Green ash	66	60	
						Eastern cottonwood	89	100	
67 Cohoctah	2W	Slight	Severe	Moderate	Moderate	Red maple	56	36	---
						Eastern cottonwood	---	---	
						Silver maple	80	34	
						White ash	---	---	
						Swamp white oak	---	---	
						American sycamore	---	---	
						Pin oak	---	---	
						Bitternut hickory	---	---	
69 Alganese	4W	Slight	Severe	Slight	Slight	Quaking aspen	60	64	---
						Silver maple	78	32	
						Swamp white oak	---	---	
						White ash	---	---	
						Red maple	---	---	
						American sycamore	---	---	
						Green ash	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
70	3W	Slight	Severe	Moderate	Moderate	Silver maple	90	42	---
Glendora						Red maple	65	40	
						Swamp white oak	---	---	
						Quaking aspen	---	---	
						Black ash	---	---	
						Eastern cottonwood	---	---	
						White ash	65	59	
71**:									
Houghton	2W	Slight	Severe	Severe	Severe	Silver maple	82	36	
						Red maple	56	36	
						White ash	56	44	
						Quaking aspen	60	64	
						Tamarack	52	45	
						Green ash	---	---	
						Northern whitecedar	37	55	
Carlisle	2W	Slight	Severe	Severe	Severe	Red maple	56	36	---
						White ash	---	---	
						Green ash	---	---	
						Quaking aspen	---	---	
						Swamp white oak	---	---	
						Silver maple	82	36	
72	2W	Slight	Severe	Severe	Severe	Silver maple	78	32	---
Adrian						Red maple	53	34	
						White ash	69	64	
						Quaking aspen	60	64	
						Tamarack	45	35	
						Green ash	69	64	
73	2W	Slight	Severe	Severe	Severe	Red maple	55	35	---
Palms						Silver maple	80	34	
						White ash	---	---	
						Quaking aspen	---	---	
						Northern whitecedar	---	---	
						Tamarack	61	61	
						Black ash	---	---	
75	2W	Slight	Severe	Severe	Severe	Red maple	55	35	---
Martisco									
77	3W	Slight	Severe	Severe	Severe	Red maple	78	49	Tamarack.
Napoleon						Silver maple	---	---	
						White ash	---	---	
						Quaking aspen	---	---	
						Tamarack	---	---	
						Black ash	---	---	
						Swamp white oak	---	---	
						Black spruce	---	---	
92B, 92C	5S	Slight	Slight	Moderate	Slight	White oak	70	66	Eastern white pine, red pine, jack pine.
Chelsea						Red pine	72	134	
						Eastern white pine	83	140	
						Jack pine	70	103	
						Quaking aspen	72	84	
						Northern red oak	70	66	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
96B**, 96C**, 96D**:									
Spinks	4A	Slight	Slight	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
Tekenink	4A	Slight	Slight	Slight	Slight	Northern red oak	66	60	Black walnut, red pine, eastern white pine, yellow-poplar.
						Black cherry	---	---	
						White ash	---	---	
						American basswood	---	---	
						American beech	---	---	
						Sugar maple	---	---	
96E**:									
Spinks	4R	Moderate	Moderate	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
Tekenink	4R	Moderate	Moderate	Slight	Slight	Northern red oak	66	60	Black walnut, red pine, eastern white pine, yellow-poplar.
						Black cherry	---	---	
						White ash	---	---	
						American basswood	---	---	
						American beech	---	---	
						Sugar maple	---	---	
97**:									
Kerston	2W	Slight	Severe	Severe	Severe	Red maple	51	33	---
						White ash	---	---	
						Green ash	---	---	
						Silver maple	---	---	
						Tamarack	---	---	
						Black ash	---	---	
						American basswood	51	35	
Carlisle	2W	Slight	Severe	Severe	Severe	Red maple	56	36	---
						White ash	---	---	
						Green ash	---	---	
						Quaking aspen	---	---	
						Swamp white oak	---	---	
						Silver maple	82	36	
98B**, 98C**, 98D**:									
Spinks	4A	Slight	Slight	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, Carolina poplar.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
Scalley	3A	Slight	Slight	Slight	Slight	Sugar maple	61	38	White spruce, eastern white pine, red pine, black walnut.
						Northern red oak	---	---	
						Black walnut	---	---	
						Black cherry	---	---	
						White ash	---	---	
						White oak	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
99B**:									
Nappanee	4C	Slight	Severe	Slight	Moderate	Northern red oak	66	60	White spruce, eastern white pine.
						White ash	---	---	
						Swamp white oak	---	---	
						Red maple	---	---	
						American beech	---	---	
Hoytville	3W	Slight	Severe	Severe	Severe	Northern red oak	55	42	---
						White ash	---	---	
						Eastern cottonwood	---	---	
						Red maple	---	---	
						Silver maple	---	---	
100B Nappanee	4C	Slight	Severe	Slight	Moderate	Northern red oak	66	60	White spruce, eastern white pine.
						White ash	---	---	
						Swamp white oak	---	---	
						Red maple	---	---	
						American beech	---	---	
101B, 101C Claybanks	4A	Slight	Slight	Slight	Slight	Northern red oak	65	59	Northern red oak, white spruce, eastern white pine, northern whitecedar.
						Sugar maple	---	---	
						White ash	---	---	
						American basswood	---	---	
						American elm	---	---	
210B**, 210C** Typic Udipsamments	2S	Slight	Moderate	Moderate	Slight	Black oak	50	34	Red pine, jack pine.
						White oak	42	26	
						Northern red oak	54	40	
210D** Typic Udipsamments	2R	Moderate	Moderate	Moderate	Slight	Black oak	50	34	Red pine, jack pine.
						White oak	42	26	
						Northern red oak	54	40	
211B**, 211C** Typic Udipsamments	3S	Slight	Moderate	Moderate	Slight	Black oak	53	34	Red pine.
						White oak	45	26	
						Northern red oak	54	40	
212B** Typic Udipsamments	3S	Slight	Moderate	Moderate	Slight	Black oak	56	34	Red pine.
						White oak	49	26	
						Northern red oak	55	42	
213B**, 213C** Argic Udipsamments	---	Slight	Moderate	Moderate	Slight	Black oak	---	---	---
						White oak	---	---	
						Northern red oak	---	---	
213D** Argic Udipsamments	---	Moderate	Moderate	Moderate	Slight	Black oak	---	---	---
						White oak	---	---	
						Northern red oak	---	---	
220B**, 220C** Entic Haplorthods, sandy	4S	Slight	Moderate	Moderate	Slight	Northern red oak	61	53	---
						White oak	52	37	
						Black oak	60	51	
						Red maple	---	---	
220D** Entic Haplorthods, sandy	4R	Moderate	Moderate	Moderate	Slight	Northern red oak	61	53	---
						White oak	52	37	
						Black oak	60	51	
						Red maple	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
220E** Entic Haplorthods, sandy	4R	Severe	Severe	Moderate	Slight	Northern red oak	61	53	---
						White oak	52	37	
						Black oak	60	51	
						Red maple	---	---	
221B**, 221C** Entic Haplorthods, sandy	4S	Slight	Moderate	Moderate	Slight	Northern red oak	65	59	---
						White oak	53	37	
						Black oak	66	51	
						Red maple	---	---	
221D** Entic Haplorthods, sandy	4R	Moderate	Moderate	Moderate	Slight	Northern red oak	65	59	---
						White oak	53	37	
						Black oak	66	51	
						Red maple	---	---	
221E** Entic Haplorthods, sandy	4R	Severe	Severe	Moderate	Slight	Northern red oak	65	59	---
						White oak	53	39	
						Black oak	66	60	
						Red maple	---	---	
222B**, 222C** Entic Haplorthods, sandy	4S	Slight	Moderate	Moderate	Slight	Northern red oak	65	59	---
						Red maple	---	---	
						White oak	55	42	
						Eastern white pine	---	---	
						Black oak	66	60	
223B**, 223C** Entic Haplorthods, sandy	4S	Slight	Moderate	Moderate	Slight	Northern red oak	65	59	---
						Red maple	---	---	
						Eastern white pine	---	---	
						White oak	53	39	
223D** Entic Haplorthods, sandy	4R	Moderate	Moderate	Moderate	Slight	Northern red oak	65	59	---
						Red maple	---	---	
						Eastern white pine	---	---	
						White oak	53	39	
223E** Entic Haplorthods, sandy	4R	Severe	Severe	Moderate	Slight	Northern red oak	65	59	---
						Red maple	---	---	
						Eastern white pine	---	---	
						White oak	53	39	
224B** Entic Haplorthods, sandy	4S	Slight	Moderate	Moderate	Slight	Northern red oak	66	60	---
						Eastern white pine	---	---	
						Paper birch	---	---	
						White oak	54	40	
						Red maple	---	---	
225B**, 225C** Entic Haplorthods, sandy	---	Slight	Moderate	Moderate	Slight	---	---	---	---
225D** Entic Haplorthods, sandy	---	Moderate	Moderate	Moderate	Slight	---	---	---	---

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
230B**, 230C** Entic Haplorthods, sandy	4S	Slight	Moderate	Moderate	Slight	Northern red oak White oak Red maple	68 60 ---	63 51 ---	---
230D** Entic Haplorthods, sandy	4R	Moderate	Moderate	Moderate	Slight	Northern red oak White oak Red maple	68 60 ---	63 51 ---	
230E** Entic Haplorthods, sandy	4R	Severe	Severe	Moderate	Slight	Northern red oak White oak Red maple	68 60 ---	63 51 ---	---
231B**:									
Entic Haplorthods, sandy	4S	Slight	Moderate	Moderate	Slight	Northern red oak White oak Black oak Red maple	61 52 60 ---	53 37 51 ---	---
Alfic Haplorthods, sandy over loamy	5S	Slight	Moderate	Moderate	Slight	Northern red oak Red maple Paper birch	77 74 ---	76 46 ---	---
233B**, 235C**:									
Alfic Haplorthods, sandy over loamy	5S	Slight	Moderate	Moderate	Slight	Northern red oak Red maple Paper birch	77 74 ---	76 46 ---	---
Entic Haplorthods; sandy	4S	Slight	Moderate	Moderate	Slight	Northern red oak White oak Black oak Red maple	61 52 60 ---	53 37 51 ---	---
233D**:									
Alfic Haplorthods, sandy over loamy	5R	Moderate	Moderate	Moderate	Slight	Northern red oak Red maple Paper birch	77 74 ---	76 46 ---	---
Entic Haplorthods, sandy	4R	Moderate	Moderate	Moderate	Slight	Northern red oak White oak Black oak Red maple	61 52 60 ---	53 37 51 ---	---

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
233E**:									
Alfic Haplorthods, sandy over loamy	5R	Severe	Severe	Moderate	Slight	Northern red oak	77	76	---
						Red maple	74	46	
						Paper birch	---	---	
Entic Haplorthods, sandy	4R	Severe	Severe	Moderate	Slight	Northern red oak	61	53	---
						White oak	52	37	
						Black oak	60	51	
						Red maple	---	---	
235B**, 235C**:									
Alfic Haplorthods, sandy over loamy	5S	Slight	Moderate	Moderate	Slight	Northern red oak	77	76	---
						Red maple	74	46	
						Paper birch	---	---	
Alfic Haplorthods, sandy	3S	Slight	Moderate	Moderate	Slight	Red maple	72	44	---
						Northern red oak	75	73	
						White oak	60	51	
240C** Entic Haplorthods, sandy	3S	Slight	Moderate	Moderate	Slight	Sugar maple	65	40	---
						Northern red oak	76	73	
						Red maple	65	40	
						American beech	---	---	
241B** Entic Haplorthods, sandy	3S	Slight	Moderate	Moderate	Slight	Sugar maple	65	40	---
						American basswood	---	---	
						American beech	---	---	
						Northern red oak	76	75	
245B**, 245C** Entic Haplorthods, sandy	3S	Slight	Moderate	Moderate	Slight	Sugar maple	75	47	---
						American beech	---	---	
						Northern red oak	88	89	
						White ash	85	88	
						American basswood	---	---	
245D** Entic Haplorthods, sandy	3R	Moderate	Moderate	Moderate	Slight	Sugar maple	75	47	---
						American beech	---	---	
						Northern red oak	88	89	
						White ash	85	88	
						American basswood	---	---	
250**:									
Mollic Psammaquents	---	Slight	Severe	Severe	Severe	Red maple	---	---	---
						Balsam fir	---	---	
						Paper birch	---	---	
						Black ash	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
250**:									
Aquic Udipsamments	4S	Slight	Moderate	Moderate	Slight	Northern red oak	65	59	---
						Red maple	---	---	
						Balsam fir	---	---	
Medisaprists, euic.									
262A** Aeric Haplaquods, sandy, orstein	4W	Slight	Severe	Moderate	Severe	Northern red oak	60	51	---
						Black oak	---	---	
						White oak	52	37	
						Red maple	---	---	
						Paper birch	---	---	
						Jack pine	---	---	
263A** Aquic Udipsamments	---	Slight	Moderate	Moderate	Slight	---	---	---	---
272** Typic Haplaquods, sandy	---	Slight	Severe	Severe	Severe	Red maple	---	---	---
						Paper birch	---	---	
						Jack pine	---	---	
						Tamarack	---	---	
273** Mollic Psammaquents	---	Slight	Severe	Severe	Severe	Black ash	---	---	---
						Green ash	---	---	
274** Typic Haplaquolls, sandy over loamy	---	Slight	Severe	Severe	Severe	Black ash	---	---	---
						Eastern hemlock	---	---	
						American basswood	---	---	
						Northern whitecedar	---	---	
						Red maple	---	---	
						White spruce	---	---	
281 Medisaprists, dysic	---	Slight	Severe	Severe	Severe	Black spruce	---	---	---
282 Medisaprists, euic	---	Slight	Severe	Severe	Severe	Northern whitecedar	---	---	---
						American basswood	---	---	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil. Only those soils suitable for windbreaks and environmental plantings are listed)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
10B, 10C, 10D, 10E-------------- Perrinton	Roselow sargent crabapple, lilac, silky dogwood, northern whitecedar, American cranberrybush, nannyberry viburnum.	White spruce, Amur maple, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	---
11A--------------- Ithaca	Northern whitecedar, silky dogwood, Amur maple, lilac, American cranberrybush, Amur privet.	White spruce, Siberian crabapple, eastern white pine, Norway spruce.	Green ash, red maple	---
12---------------- Bono	American cranberrybush, silky dogwood, Amur privet, Amur honeysuckle.	Northern whitecedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine, Norway spruce.	---
13B, 13C, 13D----- Marlette	American cranberrybush, common ninebark, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
14B--------------- Capac	Silky dogwood, American cranberrybush, Amur privet, lilac.	White spruce, northern whitecedar, Amur maple.	Eastern white pine, red maple, Norway spruce, green ash.	Imperial Carolina poplar.
16B, 16C, 16D----- Remus	Nannyberry viburnum, American cranberrybush, lilac, silky dogwood.	Northern whitecedar, Siberian crabapple, white spruce.	Norway spruce, red pine, green ash, eastern white pine.	Imperial Carolina poplar.
17B*, 17C*, 17D*:				
Marlette----------	American cranberrybush, common ninebark, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
Fern--------------	Amur maple, nannyberry viburnum, American cranberrybush, Siberian peashrub, lilac, silky dogwood.	White spruce, green ash.	Norway spruce, red pine, eastern white pine.	Imperial Carolina poplar.
18B*, 18C*, 18D*:				
Spinks------------	American cranberrybush, lilac, Siberian peashrub.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Carolina poplar.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
18B*, 18C*, 18D*:				
Gowdy	Siberian peashrub, lilac, eastern redcedar, silky dogwood, Amur maple, gray dogwood, American cranberrybush.	Norway spruce	Eastern white pine, red pine, jack pine.	---
20B*, 20C*, 20D*:				
Arkport	American cranberrybush, Amur honeysuckle, Amur privet, Washington hawthorn.	Eastern redcedar, Osage-orange, northern whitecedar, Austrian pine.	Red pine, Norway spruce, eastern white pine.	---
Chelsea	Eastern redcedar	Red pine, jack pine, Austrian pine.	Eastern white pine	---
21A Freesoil	Lilac, silky dogwood, nannyberry viburnum, arrowwood, Roselow sargent crabapple, autumn olive.	Manchurian crabapple, white spruce, Austrian pine.	Norway spruce, green ash.	Imperial Carolina poplar.
22B, 22C Gowdy	Siberian peashrub, lilac, eastern redcedar, silky dogwood, Amur maple, gray dogwood, American cranberrybush.	Norway spruce	Eastern white pine, red pine, jack pine.	---
23A Arkona	American cranberrybush, silky dogwood, lilac, nannyberry viburnum.	Northern whitecedar, blue spruce, Siberian crabapple.	Eastern white pine, Norway spruce, green ash.	Carolina poplar.
25B*, 25C*, 25D*, 25E*:				
Gowdy	Siberian peashrub, lilac, eastern redcedar, silky dogwood, Amur maple, gray dogwood, American cranberrybush.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Perrinton	Roselow sargent crabapple, lilac, silky dogwood, northern whitecedar, American cranberrybush, nannyberry viburnum.	White spruce, Amur maple, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
26A*:				
Arkona	American cranberrybush, silky dogwood, lilac, nannyberry viburnum.	Northern whitecedar, blue spruce, Siberian crabapple.	Eastern white pine, Norway spruce, green ash.	Carolina poplar.
Ithaca	Northern whitecedar, silky dogwood, Amur maple, lilac, American cranberrybush, Amur privet.	White spruce, Siberian crabapple, eastern white pine, Norway spruce.	Green ash, red maple	---
27B*:				
Arkona	American cranberrybush, silky dogwood, lilac, nannyberry viburnum.	Northern whitecedar, blue spruce, Siberian crabapple.	Eastern white pine, Norway spruce, green ash.	Carolina poplar.
Del Rey	American cranberrybush, Amur privet, late lilac.	Eastern white pine, white spruce.	White ash, red pine, red maple, Norway spruce, Black Hills spruce.	Green ash.
28B, 28C, 28D Fern	Amur maple, nannyberry viburnum, American cranberrybush, Siberian peashrub, lilac, silky dogwood.	White spruce, green ash.	Norway spruce, red pine, eastern white pine.	Imperial Carolina poplar.
29A Dixboro	Nannyberry viburnum, American cranberrybush, gray dogwood.	White spruce, northern whitecedar.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
30 Lamson	American cranberrybush, Amur privet, silky dogwood.	Northern whitecedar, white spruce.	Eastern white pine, green ash.	---
35B*, 35C*, 35D*:				
Alvin	Eastern redcedar, Russian-olive, silky dogwood, Siberian peashrub.	Norway spruce, eastern white pine, honeylocust, green ash, red pine, hackberry, Amur maple.	---	---
Spinks	American cranberrybush, lilac, Siberian peashrub.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Carolina poplar.
36A Del Rey	American cranberrybush, Amur privet, late lilac.	Eastern white pine, white spruce.	White ash, red pine, red maple, Norway spruce, Black Hills spruce.	Green ash.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
37A--------------- Altmar	Lilac, silky dogwood, Roselow sargent crabapple, autumn olive.	White spruce, Amur maple, Manchurian crabapple, Austrian pine.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
38B*, 38C*, 38D*, 38E*:				
Spinks----------	American cranberrybush, silky dogwood, lilac, Siberian peashrub.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Carolina poplar.
Okee------------	Siberian peashrub, eastern redcedar, Russian-olive.	Eastern white pine, red pine, honeylocust, Norway spruce, green ash, hackberry, Amur maple.	---	---
40B*, 40C*, 40D*:				
Coloma-----------	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce---------	Eastern white pine, red pine, jack pine.	---
Toogood----------	Eastern redcedar, Siberian peashrub, Siberian dogwood, Peking cotoneaster, lilac.	Jack pine, Austrian pine, red pine, honeylocust, black locust.	Eastern white pine----	---
42B*, 42C*, 42D*, 42E*:				
Spinks----------	American cranberrybush, silky dogwood, lilac, Siberian peashrub.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Carolina poplar.
Remus-----------	Nannyberry viburnum, American cranberrybush, lilac, silky dogwood.	Northern whitecedar, Siberian crabapple, white spruce.	Norway spruce, red pine, green ash, eastern white pine.	Imperial Carolina poplar.
Fern------------	Amur maple, nannyberry viburnum, American cranberrybush, Siberian peashrub, lilac, silky dogwood.	White spruce, green ash.	Norway spruce, red pine, eastern white pine.	Imperial Carolina poplar.
43B, 43C, 43D, 43E-------------- Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Carolina poplar.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
44B Thetford	Silky dogwood, lilac, American cranberrybush.	White spruce, northern whitecedar, Amur maple.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
45B*, 45C*, 45D*, 45E*, 45F*:				
Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Carolina poplar.
Benona	Eastern redcedar, Siberian peashrub, red pine.	Austrian pine, jack pine.	Eastern white pine	---
46B Grattan	Lilac, eastern redcedar, Siberian peashrub.	Red pine, Austrian pine, jack pine.	Eastern white pine	---
48A*:				
Saugatuck	Siberian peashrub, lilac, silky dogwood, nannyberry viburnum, common ninebark, American cranberrybush.	White spruce, northern whitecedar, Siberian crabapple.	Eastern white pine, Norway spruce, green ash.	---
Jebavy.				
49B, 49B3, 49C, 49C3, 49E, 49F Grattan	Lilac, eastern redcedar, Siberian peashrub, Tatarian honeysuckle.	Siberian crabapple, Austrian pine, jack pine.	Red pine, eastern white pine.	---
50B Covert	Lilac, eastern redcedar, Siberian peashrub.	Austrian pine, jack pine, red pine.	Eastern white pine	---
51B Pipestone	Lilac, silky dogwood, American cranberrybush.	Northern whitecedar, Amur maple, white spruce.	Red maple, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
52 Granby	Amur privet, silky dogwood, American cranberrybush, nannyberry viburnum.	Northern whitecedar, white spruce, Manchurian crabapple, green ash, lilac.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
53B, 53C Grattan	Eastern redcedar, lilac, Siberian peashrub, smooth sumac, hedge cotoneaster, staghorn sumac.	Red pine, eastern white pine, Austrian pine, jack pine.	---	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
56B, 56C, 56E Benona	Eastern redcedar, Peking cotoneaster, lilac, smooth sumac, Siberian peashrub, staghorn sumac.	Austrian pine, jack pine, red pine.	---	---
57C, 57F Nordhouse	Eastern redcedar, lilac, Siberian peashrub.	Red pine, jack pine, Austrian pine.	Eastern white pine	---
59B, 59C, 59E Benona	Eastern redcedar, Siberian peashrub, red pine.	Austrian pine, jack pine.	Eastern white pine	---
60B, 60C, 60E Coloma	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce	Eastern white pine, red pine, jack pine.	---
61B, 61C, 61E Epworth	Eastern redcedar, Siberian peashrub, lilac.	Austrian pine, red pine, jack pine.	Eastern white pine	---
62B, 62C Plainfield	Siberian peashrub, lilac, eastern redcedar, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce	Eastern white pine, red pine, jack pine.	---
65 Sloan	Green ash, silky dogwood, Amur privet, white spruce, American cranberrybush.	Northern whitecedar, Manchurian crabapple.	Golden willow	Carolina poplar.
67 Cohoctah	European privet, American cranberrybush, lilac, nannyberry viburnum.	Northern whitecedar, Manchurian crabapple, white spruce.	Green ash, Norway spruce, eastern white pine.	Imperial Carolina poplar.
71*:				
Houghton	Silky dogwood, lilac, Amur privet, common ninebark, nannyberry viburnum.	Siberian crabapple, northern whitecedar.	Green ash, Norway spruce, eastern white pine.	Imperial Carolina poplar.
Carlisle.				
92B, 92C Chelsea	Eastern redcedar	Red pine, jack pine, Austrian pine.	Eastern white pine	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
96B*, 96C*, 96D*, 96E*:				
Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Carolina poplar.
Tekenink	Amur privet, nannyberry viburnum, lilac, silky dogwood, American cranberrybush.	White spruce, northern whitecedar, green ash.	Eastern white pine, red pine, Norway spruce.	Imperial Carolina poplar.
98B*, 98C*, 98D*:				
Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Carolina poplar.
Scalley	Lilac, Roselow sargent crabapple, silky dogwood, Amur honeysuckle, eastern redcedar, Siberian peashrub.	Austrian pine, Siberian crabapple, jack pine.	Eastern white pine, red pine, green ash.	---
99B*:				
Nappanee	Silky dogwood, American cranberrybush, lilac, sargent crabapple.	White spruce, northern whitecedar, Amur maple, Siberian crabapple.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
Hoytville	Nannyberry viburnum, American cranberrybush, silky dogwood, Amur privet.	Northern whitecedar, Manchurian crabapple, white spruce.	Norway spruce, green ash, eastern white pine.	Carolina poplar.
100B Nappanee	Silky dogwood, American cranberrybush, lilac, sargent crabapple.	White spruce, northern whitecedar, Amur maple, Siberian crabapple.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
101B, 101C Claybanks	Nannyberry viburnum, American cranberrybush, common ninebark, lilac, sargent crabapple.	Eastern white pine, white spruce, Norway spruce.	Green ash	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
10B------------------- Perrinton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Severe: erodes easily.
10C------------------- Perrinton	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.
10D------------------- Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
10E------------------- Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
11A------------------- Ithaca	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
12-------------------- Bono	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
13B------------------- Marlette	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight.
13C------------------- Marlette	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
13D------------------- Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
14B------------------- Capac	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
16B------------------- Remus	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
16C------------------- Remus	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
16D------------------- Remus	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
17B*:				
Marlette-------------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
17B*:				
Fern	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
17C*:				
Marlette	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
Fern	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
17D*:				
Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Fern	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
18B*:				
Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Gowdy	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
18C*:				
Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Gowdy	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
18D*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Gowdy	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
20B*:				
Arkport	Slight	Slight	Moderate: slope.	Slight.
Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
20C*:				
Arkport	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
20C*:				
Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
20D*:				
Arkport	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Chelsea	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
21A Freesoil	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
22B Gowdy	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
22C Gowdy	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
23A Arkona	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.
24 Sickles	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
25B*:				
Gowdy	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
Perrinton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Severe: erodes easily.
25C*:				
Gowdy	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Perrinton	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.
25D*:				
Gowdy	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
25E*:				
Gowdy	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
26A*:				
Arkona	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.
Ithaca	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
27B*:				
Arkona	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.
Del Rey	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
28B Fern	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.
28C Fern	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
28D Fern	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
29A Dixboro	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
30 Lamson	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
35B*:				
Alvin	Slight	Slight	Moderate: slope.	Slight.
Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.
35C*:				
Alvin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
35D*:				
Alvin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
36A Del Rey	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
37A Altmar	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
38B*:				
Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Okee	Slight	Slight	Moderate: slope.	Slight.
38C*:				
Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Okee	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
38D*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Okee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
38E*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Okee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
40B*:				
Coloma	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Toogood	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
40C*:				
Coloma	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
40C*:				
Toogood	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
40D*:				
Coloma	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Toogood	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
41 Granby	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
42B*:				
Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Remus	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
Fern	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
42C*:				
Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Remus	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Fern	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
42D*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Remus	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Fern	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
42E*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Remus	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
42E*:				
Fern	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
43B Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
43C Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
43D Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
43E Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
44B Thetford	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
45B*:				
Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Benona	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
45C*:				
Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Benona	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
45D*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Benona	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
45E*, 45F*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Benona	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
46B Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
48A*:				
Saugatuck	Severe: wetness, too sandy, cemented pan.	Severe: wetness, too sandy, cemented pan.	Severe: too sandy, wetness, cemented pan.	Severe: wetness, too sandy.
Jebavy	Severe: ponding, too sandy, cemented pan.	Severe: ponding, too sandy, cemented pan.	Severe: too sandy, ponding, cemented pan.	Severe: ponding, too sandy.
49B, 49B3 Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
49C, 49C3 Grattan	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
49E, 49F Grattan	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
50B Covert	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
51B Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
52 Granby	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.
53B Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
53C Grattan	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
56B Benona	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
56C Benona	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
56E Benona	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
57C Nordhouse	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
57F Nordhouse	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
58-------------------- Kingsville	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.
59B------------------- Benona	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
59C------------------- Benona	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
59E------------------- Benona	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
60B------------------- Coloma	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
60C------------------- Coloma	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
60E------------------- Coloma	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
61B------------------- Epworth	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
61C------------------- Epworth	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
61E------------------- Epworth	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
62B------------------- Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
62C------------------- Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
65-------------------- Sloan	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
67-------------------- Cohoctah	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
69-------------------- Algansee	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
70-------------------- Glendora	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
71*:				
Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Carlisle	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
72 Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
73 Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
75 Martisco	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
77 Napoleon	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.
83*:				
Histosols	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Aquents	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
84F*:				
Dune land.				
Quartzipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Psammaquents	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.
85F*:				
Udorthents	Variable	Variable	Variable	Variable.
Quartzipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
86F*:				
Dune land.				
Quartzipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
87. Beaches				
88A Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
89A Udorthents	Variable	Variable	Variable	Variable.
91. Pits, sand and gravel				
92B Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
92C Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
96B*:				
Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Tekenink	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
96C*:				
Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Tekenink	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
96D*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Tekenink	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.
96E*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tekenink	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
97*:				
Kerston	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
97*:				
Carlisle	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.
98B*:				
Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Scalley	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Modertate: too sandy.
98C*:				
Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Scalley	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
98D*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Scalley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.
99B*:				
Nappanee	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
Hoytville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
100B Nappanee	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
101B Claybanks	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Severe: erodes easily.
101C Claybanks	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.
210B* Typic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
210C* Typic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
210D*----------------- Typic Udipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
211B*----------------- Typic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
211C*----------------- Typic Udipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
212B*----------------- Typic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
213B*----------------- Argic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
213C*----------------- Argic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
213D*----------------- Argic Udipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
220B*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
220C*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
220D*----------------- Entic Haplorthods, sandy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
220E*----------------- Entic Haplorthods, sandy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
221B*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
221C*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
221D*----------------- Entic Haplorthods, sandy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
221E*----------------- Entic Haplorthods, sandy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
222B*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
222C*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
223B*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
223C*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
223D*----------------- Entic Haplorthods, sandy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
223E*----------------- Entic Haplorthods, sandy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
224B*, 225B*---------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
225C*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
225D*----------------- Entic Haplorthods, sandy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
230B*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
230C*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
230D*----------------- Entic Haplorthods, sandy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
230E*----------------- Entic Haplorthods, sandy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
231B*:				
Entic Haplorthods, sandy---------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Alfic Haplorthods, sandy over loamy----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
233B*:				
Alfic Haplorthods, sandy over loamy----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
233B*:				
Entic Haplorthods, sandy----------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
233C*:				
Alfic Haplorthods, sandy over loamy----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Entic Haplorthods, sandy----------------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
233D*:				
Alfic Haplorthods, sandy over loamy----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Entic Haplorthods, sandy----------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
233E*:				
Alfic Haplorthods, sandy over loamy----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Entic Haplorthods, sandy----------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
235B*:				
Alfic Haplorthods, sandy over loamy----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Alfic Haplorthods, sandy----------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
235C*:				
Alfic Haplorthods, sandy over loamy----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Alfic Haplorthods, sandy----------------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
240C*------------------ Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
241B*, 245B*---------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
245C*----------------- Entic Haplorthods, sandy	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
245D*----------------- Entic Haplorthods, sandy	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
250*:				
Mollic Psammaquents--	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Aquic Udipsamments---	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Medisaprists, euic---	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
262A*----------------- Aeric Haplaquods, sandy, ortstein	Severe: wetness, too sandy, cemented pan.	Severe: wetness, too sandy, cemented pan.	Severe: too sandy, wetness, cemented pan.	Severe: wetness, too sandy.
263A*----------------- Aquic Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
272*------------------ Typic Haplaquods, sandy	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.
273*------------------ Mollic Psammaquents	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
274*------------------ Typic Haplaquolls, sandy over loamy	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
280*:				
Aquents--------------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Histosols------------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
281------------------- Medisaprists, dysic	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
282------------------- Medisaprists, euic	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
10B Perrinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
10C Perrinton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
10D Perrinton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
10E Perrinton	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
11A Ithaca	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
12 Bono	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
13B Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
13C Marlette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
13D Marlette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
14B Capac	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor.
16B Remus	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
16C, 16D Remus	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
17B*:										
Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Fern	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Good.
17C*:										
Marlette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Fern	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Good.
17D*:										
Marlette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Fern	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
18B*:										
Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Gowdy	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
18C*, 18D*:										
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Gowdy	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
20B*:										
Arkport	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
20C*:										
Arkport	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
20D*:										
Arkport	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
21A Freesoil	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
22B Gowdy	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
22C Gowdy	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
23A Arkona	Fair	Fair	Good	Fair	Fair	Poor	Fair	Fair	Fair	Poor.
24 Sickles	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
25B*:										
Gowdy	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Perrinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
25C*:										
Gowdy	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.
Perrinton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
25D*:										
Gowdy	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Perrinton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
25E*:										
Gowdy	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Perrinton	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
26A*:										
Arkona	Fair	Fair	Good	Fair	Fair	Poor	Fair	Fair	Fair	Poor.
Ithaca	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
27B*:										
Arkona	Fair	Fair	Good	Fair	Fair	Poor	Fair	Fair	Fair	Poor.
Del Rey	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
28B, 28C Fern	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Good.
28D Fern	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Good.
29A Dixboro	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
30 Lamson	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
35B*:										
Alvin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
35C*:										
Alvin	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
35D*:										
Alvin	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
36A Del Rey	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
37A Altmar	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Poor.
38B*:										
Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Okee	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
38C*:										
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Okee	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
38D*:										
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Okee	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
38E*:										
Spinks	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Okee	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
40B*:										
Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Toogood	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
40C*, 40D*:										
Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Toogood	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
41 Granby	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
42B*:										
Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Remus	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Fern	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Good.
42C*, 42D*:										
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Remus	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Fern	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Good.
42E*:										
Spinks	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Remus	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Fern	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Good.
43B Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
43C, 43D Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
43E Spinks	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
44B Thetford	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
45B*:										
Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Benona	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
45C*, 45D*:										
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Benona	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
45E*, 45F*:										
Spinks	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
45E*, 45F*:										
Benona------------	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
46B---------------- Grattan	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
48A*:										
Saugatuck---------	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Poor.
Jebavy------------	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
49B, 49B3---------- Grattan	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
49C, 49C3, 49E, 49F--------------- Grattan	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
50B---------------- Covert	Poor	Poor	Fair	Good	Good	Poor	Poor	Poor	Good	Poor.
51B---------------- Pipestone	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
52----------------- Granby	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
53B, 53C----------- Grattan	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
56B---------------- Benona	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
56C---------------- Benona	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
56E---------------- Benona	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
57C---------------- Nordhouse	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
57F---------------- Nordhouse	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.
58----------------- Kingsville	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
59B---------------- Benona	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
59C---------------- Benona	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
59E---------------- Benona	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
60B----------------- Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
60C----------------- Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
60E----------------- Coloma	Very poor.	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
61B----------------- Epworth	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
61C----------------- Epworth	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
61E----------------- Epworth	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
62B----------------- Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
62C----------------- Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
65------------------ Sloan	Fair	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good.
67------------------ Cohoctah	Poor	Poor	Poor	Good	Good	Good	Good	Poor	Good	Good.
69------------------ Algansee	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
70------------------ Glendora	Very poor.	Very poor.	Fair	Fair	Fair	Good	Good	Very poor.	Fair	Good.
71*:										
Houghton-----------	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Carlisle-----------	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
72------------------ Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
73------------------ Palms	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
75------------------ Martisco	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
77------------------ Napoleon	Very poor.	Very poor.	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
83*:										
Histosols.										
Aquents.										

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
84F*:										
Dune land.										
Quartzipsamments.										
Psammaquents.										
85F*:										
Udorthents.										
Quartzipsamments.										
86F*:										
Dune land.										
Quartzipsamments.										
87. Beaches										
88A. Udipsamments										
89A. Udorthents										
91. Pits, sand and gravel										
92B Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
92C Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
96B*:										
Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Tekenink	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
96C*, 96D*:										
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Tekenink	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
96E*:										
Spinks	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Tekenink	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
97*:										
Kerston	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Carlisle	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
98B*:										
Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Scalley	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
98C*, 98D*:										
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Scalley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
99B*:										
Nappanee	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Hoytville	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
100B Nappanee	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
101B Claybanks	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
101C Claybanks	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
210B* Typic Udipsamments	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
210C*, 210D* Typic Udipsamments	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
211B* Typic Udipsamments	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
211C* Typic Udipsamments	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
212B* Typic Udipsamments	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
213B* Argic Udipsamments	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
213C* Argic Udipsamments	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
213D*. Argic Udipsamments										

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
220B* Entic Haplorthods, sandy	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
220C*, 220D*, 220E* Entic Haplorthods, sandy	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
221B* Entic Haplorthods, sandy	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
221C*, 221D*, 221E* Entic Haplorthods, sandy	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
222B*, 222C*, 223B* Entic Haplorthods, sandy	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
223C*, 223D*, 223E* Entic Haplorthods, sandy	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
224B* Entic Haplorthods, sandy	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
225B* Entic Haplorthods, sandy	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
225C*, 225D* Entic Haplorthods, sandy	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
230B* Entic Haplorthods, sandy	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
230C*, 230D*, 230E* Entic Haplorthods, sandy	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
231B*:										
Entic Haplorthods, sandy	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Alfic Haplorthods, sandy over loamy	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
233B*:										
Alfic Haplorthods, sandy over loamy	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Entic Haplorthods, sandy	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
233C*, 233D*, 233E*:										
Alfic Haplorthods, sandy over loamy	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Entic Haplorthods, sandy	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
235B*:										
Alfic Haplorthods, sandy over loamy	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Alfic Haplorthods, sandy	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
235C*:										
Alfic Haplorthods, sandy over loamy	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Alfic Haplorthods, sandy	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
240C* Entic Haplorthods, sandy	Poor	Poor	Poor	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
241B*: Entic Haplorthods, sandy	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
245B*: Entic Haplorthods, sandy	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
245C*, 245D*: Entic Haplorthods, sandy	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
250*:										
Mollic Psammaquents	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Aquic Udipsamments	Poor	Poor	Fair	Good	Good	Fair	Poor	Poor	Good	Fair.
Medisaprists, euic	Very poor.	Very poor.	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
262A*: Aeric Haplaquods, sandy, ortstein	Poor	Poor	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor.
263A*: Aquic Udipsamments	Poor	Poor	Fair	Good	Good	Poor	Poor	Poor	Good	Poor.
272*: Typic Haplaquods, sandy	Very poor.	Poor	Poor	Fair	Poor	Good	Good	Very poor.	Fair	Good.
273*: Mollic Psammaquents	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
274*: Typic Haplaquolls, sandy over loamy	Poor	Poor	Good	Fair	Fair	Good	Good	Poor	Good	Good.
280*:										
Aquents.										
Histosols.										
281: Medisaprists, dysic	Very poor.	Very poor.	Poor	Poor	Poor	Fair	Fair	Very poor.	Poor	Fair.
282: Medisaprists, euic	Very poor.	Very poor.	Poor	Poor	Fair	Good	Good	Very poor.	Fair	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
10B Perrinton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
10C Perrinton	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
10D, 10E Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
11A Ithaca	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
12 Bono	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	---
13B Marlette	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
13C Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
13D Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
14B Capac	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
16B Remus	Slight	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
16C Remus	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
16D Remus	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
17B*:						
Marlette	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
Fern	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty, too sandy.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
17C*:						
Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Fern	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope, too sandy.
17D*:						
Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Fern	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
18B*:						
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Gowdy	Severe: cutbanks cave.	Slight	Severe: shrink-swell.	Slight	Moderate: frost action.	Moderate: droughty.
18C*:						
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Gowdy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
18D*:						
Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gowdy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: slope.	Severe: slope.
20B*:						
Arkport	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
Chelsea	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
20C*:						
Arkport	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
20D*:						
Arkport	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Chelsea	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
21A Freesoil	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
22B Gowdy	Severe: cutbanks cave.	Slight	Slight	Severe: shrink-swell.	Moderate: frost action.	Moderate: droughty.
22C Gowdy	Severe: cutbanks cave.	Moderate: slope.	Severe: shrink-swell.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
23A Arkona	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
24 Sickles	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
25B*:						
Gowdy	Severe: cutbanks cave.	Slight	Severe: shrink-swell.	Slight	Moderate: frost action.	Moderate: droughty.
Perrinton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
25C*:						
Gowdy	Severe: cutbanks cave.	Moderate: slope.	Severe: shrink-swell.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
Perrinton	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
25D*, 25E*:						
Gowdy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: slope.	Severe: slope.
Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
26A*:						
Arkona	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Ithaca	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
27B*:						
Arkona	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Del Rey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
28B Fern	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
28C Fern	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
28D Fern	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
29A Dixboro	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
30 Lamson	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
35B*:						
Alvin	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
35C*:						
Alvin	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
35D*:						
Alvin	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
36A Del Rey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
37A Altmar	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Severe: droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
38B*:						
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Okee	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: large stones, droughty.
38C*:						
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Okee	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
38D*, 38E*:						
Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Okee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
40B*:						
Coloma	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
Toogood	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
40C*:						
Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Toogood	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
40D*:						
Coloma	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Toogood	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
41 Granby	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
42B*:						
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
42B*:						
Remus	Slight	Slight	Slight	Slight	Moderate: frost action.	Moderate: large stones, droughty.
Fern	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty, too sandy.
42C*:						
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Remus	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fern	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
42D*, 42E*:						
Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Remus	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fern	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
43B Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
43C Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
43D, 43E Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
44B Thetford	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
45B*:						
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Benona	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
45C*:						
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
45C*: Benona	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
45D*, 45E*, 45F*: Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Benona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
46B Grattan	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
48A*: Saugatuck	Severe: cemented pan, cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, cemented pan.	Severe: wetness.	Severe: wetness.	Severe: wetness, cemented pan.
Jebavy	Severe: cemented pan, cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, cemented pan.	Severe: ponding.	Severe: ponding.	Severe: ponding, droughty, cemented pan.
49B, 49B3 Grattan	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
49C, 49C3 Grattan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
49E, 49F Grattan	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
50B Covert	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
51B Pipestone	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
52 Granby	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
53B Grattan	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
53C Grattan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
56B Benona	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
56C--------------- Benona	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
56E--------------- Benona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
57C--------------- Nordhouse	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
57F--------------- Nordhouse	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
58---------------- Kingsville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
59B--------------- Benona	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, too sandy.
59C--------------- Benona	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
59E--------------- Benona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
60B--------------- Coloma	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
60C--------------- Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
60E--------------- Coloma	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
61B--------------- Epworth	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
61C--------------- Epworth	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
61E--------------- Epworth	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
62B--------------- Plainfield	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
62C--------------- Plainfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
65---------------- Sloan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
67---------------- Cohoctah	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness.
69---------------- Algansee	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, droughty, flooding.
70---------------- Glendora	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness.
71*:						
Houghton----------	Severe: ponding, excess humus.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: excess humus, ponding.
Carlisle----------	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
72---------------- Adrian	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
73---------------- Palms	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
75---------------- Martisco	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
77---------------- Napoleon	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: too acid, ponding, excess humus.
83*:						
Histosols--------	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
Aquents----------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
84F*: Dune land.						

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
84F*:						
Quartzipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Psammaquents	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
85F*:						
Udorthents	Variable	Variable	Variable	Variable	Variable	Variable.
Quartzipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
86F*:						
Dune land.						
Quartzipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
87. Beaches						
88A Udipsamments	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
89A Udorthents	Variable	Variable	Variable	Variable	Variable	Variable.
91. Pits, sand and gravel						
92B Chelsea	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
92C Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
96B*:						
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Tekenink	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: large stones, droughty.
96C*:						
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Tekenink	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
96D*, 96E*:						
Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tekenink	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
97*:						
Kerston	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, ponding, flooding.	Severe: ponding, flooding, excess humus.
Carlisle	Severe: excess humus, ponding.	Severe: flooding, ponding, subsides.	Severe: flooding, ponding, subsides.	Severe: flooding, ponding, subsides.	Severe: ponding, flooding, subsides.	Severe: ponding, flooding, excess humus.
98B*:						
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Scalley	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
98C*:						
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Scalley	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
98D*:						
Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Scalley	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
99B*:						
Nappanee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.	Moderate: wetness, droughty.
Hoytville	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
100B Nappanee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.	Moderate: wetness, droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
101B Claybanks	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
101C Claybanks	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
210B* Typic Udipsamments	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
210C* Typic Udipsamments	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
210D* Typic Udipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
211B* Typic Udipsamments	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
211C* Typic Udipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
212B* Typic Udipsamments	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty, too sandy.
213B* Argic Udipsamments	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
213C* Argic Udipsamments	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
213D* Argic Udipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
220B* Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
220C* Entic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
220D*, 220E* Entic Haplorthods, sandy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
221B*: Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
221C*: Entic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
221D*, 221E*: Entic Haplorthods, sandy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
222B*: Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty, too sandy.
222C*: Entic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
223B*: Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
223C*: Entic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
223D*, 223E*: Entic Haplorthods, sandy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
224B*: Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty, too sandy.
225B*: Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
225C*: Entic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
225D*: Entic Haplorthods, sandy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
230B* Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
230C* Entic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
230D*, 230E* Entic Haplorthods, sandy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
231B*:						
Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
Alfic Haplorthods, sandy over loamy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
233B*:						
Alfic Haplorthods, sandy over loamy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
233C*:						
Alfic Haplorthods, sandy over loamy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
Entic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
233D*, 233E*:						
Alfic Haplorthods, sandy over loamy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
233D*, 233E*:						
Entic Haplorthods, sandy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
235B*:						
Alfic Haplorthods, sandy over loamy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
Alfic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.	Moderate: droughty, too sandy.
235C*:						
Alfic Haplorthods, sandy over loamy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
Alfic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: droughty, slope, too sandy.
240C* Entic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
241B* Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
245B* Entic Haplorthods, sandy	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
245C* Entic Haplorthods, sandy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
245D* Entic Haplorthods, sandy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
250*:						
Mollic Psammaquents-----	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding, excess humus.
Aquic Udipsamments-----	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: wetness, droughty, flooding.
250*:						
Medisaprists, euic-------------	Severe: excess humus, ponding.	Severe: flooding, ponding, low strength.	Severe: flooding, ponding.	Severe: flooding, ponding, low strength.	Severe: ponding, flooding, frost action.	Severe: ponding, excess humus.
262A*-------------- Aeric Haplaquods, sandy, ortstein	Severe: cemented pan, cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, cemented pan.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty, cemented pan.
263A*-------------- Aquic Udipsamments	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty, too sandy.
272*--------------- Typic Haplaquods, sandy	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
273*--------------- Mollic Psammaquents	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
274*--------------- Typic Haplaquolls, sandy over loamy	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
280*:						
Aquents-----------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Histosols---------	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
281---------------- Medisaprists, dysic	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
282---------------- Medisaprists, euic	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10B----------------- Perrinton	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
10C----------------- Perrinton	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
10D, 10E------------ Perrinton	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
11A----------------- Ithaca	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
12------------------ Bono	Severe: ponding, percs slowly.	Slight-----------	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
13B----------------- Marlette	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
13C----------------- Marlette	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
13D----------------- Marlette	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
14B----------------- Capac	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
16B----------------- Remus	Severe: percs slowly.	Moderate: slope.	Slight-----------	Slight-----------	Good.
16C----------------- Remus	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
16D----------------- Remus	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
17B*:					
Marlette-----------	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
17B*:					
Fern	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
17C*:					
Marlette	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Fern	Moderate: percs slowly.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
17D*:					
Marlette	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Fern	Severe: slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
18B*:					
Spinks	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Gowdy	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
18C*:					
Spinks	Slight	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Gowdy	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
18D*:					
Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Gowdy	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too clayey.	Severe: seepage, slope.	Poor: too clayey, hard to pack, slope.
20B*:					
Arkport	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: too sandy, thin layer.
Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
20C*:					
Arkport	Moderate: slope.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: slope, too sandy, thin layer.
Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
20D*:					
Arkport	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: slope.
Chelsea	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: seepage, too sandy, slope.
21A Freesoil	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.
22B Gowdy	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
22C Gowdy	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
23A Arkona	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
24 Sickles	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
25B*:					
Gowdy	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
Perrinton	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
25C*:					
Gowdy	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
Perrinton	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
25D*, 25E*:					
Gowdy	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too clayey.	Severe: seepage, slope.	Poor: too clayey, hard to pack, slope.
Perrinton	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
26A*:					
Arkona	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
Ithaca	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
27B*:					
Arkona	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
Del Rey	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
28B Fern	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
28C Fern	Moderate: percs slowly.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
28D Fern	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
29A Dixboro	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.
30 Lamson	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding, thin layer.
35B*:					
Alvin	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
35B*:					
Spinks	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
35C*:					
Alvin	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage.
Spinks	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
35D*:					
Alvin	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope.
Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
36A Del Rey	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
37A Altmar	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
38B*:					
Spinks	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Okee	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
38C*:					
Spinks	Slight	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Okee	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
38D*, 38E*:					
Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
38D*, 38E*:					
Okee	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
40B*:					
Coloma	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Toogood	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
40C*:					
Coloma	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Toogood	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
40D*:					
Coloma	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Toogood	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
41 Granby	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
42B*:					
Spinks	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Remus	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
Fern	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
42C*:					
Spinks	Slight	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Remus	Severe: percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
42C*:					
Fern	Slight	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
42D*, 42E*:					
Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Remus	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Fern	Severe: slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
43B Spinks	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
43C Spinks	Slight	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
43D, 43E Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
44B Thetford	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.
45B*:					
Spinks	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Benona	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
45C*:					
Spinks	Slight	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Benona	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
45D*, 45E*, 45F*:					
Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Benona	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
46B Grattan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
48A*:					
Saugatuck	Severe: cemented pan, wetness, poor filter.	Severe: seepage, cemented pan, wetness.	Severe: seepage, wetness, too sandy.	Severe: cemented pan, seepage, wetness.	Poor: cemented pan, seepage, too sandy.
Jebavy	Severe: cemented pan, ponding, poor filter.	Severe: seepage, cemented pan, ponding.	Severe: seepage, ponding, too sandy.	Severe: cemented pan, seepage, ponding.	Poor: cemented pan, seepage, too sandy.
49B, 49B3 Grattan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
49C, 49C3 Grattan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
49E, 49F Grattan	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
50B Covert	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
51B Pipestone	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
52 Granby	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
53B Grattan	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
53C Grattan	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
56B----------------- Benona	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
56C----------------- Benona	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
56E----------------- Benona	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
57C----------------- Nordhouse	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
57F----------------- Nordhouse	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
58------------------ Kingsville	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
59B----------------- Benona	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
59C----------------- Benona	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
59E----------------- Benona	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
60B----------------- Coloma	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
60C----------------- Coloma	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
60E----------------- Coloma	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
61B----------------- Epworth	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
61C----------------- Epworth	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
61E------------------ Epworth	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope.
62B------------------ Plainfield	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
62C------------------ Plainfield	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
65------------------- Sloan	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
67------------------- Cohoctah	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
69------------------- Algansee	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
70------------------- Glendora	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
71*:					
Houghton------------	Severe: subsides, ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Carlisle------------	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
72------------------- Adrian	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
73------------------- Palms	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
75------------------- Martisco	Severe: ponding, percs slowly.	Severe: seepage, excess humus.	Severe: ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
77------------------ Napoleon	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
83*:					
Histosols----------	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.
Aquents------------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
84F*: Dune land.					
Quartzipsamments---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope.
Psammaquents-------	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
85F*:					
Udorthents---------	Variable---------	Variable---------	Variable---------	Variable---------	Variable.
Quartzipsamments---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope.
86F*: Dune land.					
Quartzipsamments---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope.
87. Beaches					
88A----------------- Udipsamments	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
89A----------------- Udorthents	Variable---------	Variable---------	Variable---------	Variable---------	Variable.
91. Pits, sand and gravel					
92B----------------- Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
92C------------------ Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
96B*:					
Spinks-------------	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Tekenink-----------	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: seepage.	Slight-----------	Fair: too sandy, small stones.
96C*:					
Spinks-------------	Slight-----------	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Tekenink-----------	Moderate: percs slowly.	Severe: slope.	Severe: seepage.	Moderate: slope.	Fair: too sandy, small stones, slope.
96D*, 96E*:					
Spinks-------------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Tekenink-----------	Severe: slope.	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
97*:					
Kerston------------	Severe: flooding, ponding, percs slowly.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, ponding.
Carlisle-----------	Severe: flooding, ponding, subsides.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding, excess humus.
98B*:					
Spinks-------------	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Scalley------------	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
98C*:					
Spinks-------------	Slight-----------	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
98C*:					
Scalley	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
98D*:					
Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Scalley	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
99B*:					
Nappanee	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Hoytville	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
100B Nappanee	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
101B Claybanks	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
101C Claybanks	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
210B* Typic Udipsamments	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
210C* Typic Udipsamments	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
210D* Typic Udipsamments	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
211B* Typic Udipsamments	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
211C*: Typic Udipsamments	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
212B*: Typic Udipsamments	Severe: poor filter.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
213B*: Argic Udipsamments	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
213C*: Argic Udipsamments	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
213D*: Argic Udipsamments	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
220B*: Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
220C*: Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
220D*, 220E*: Entic Haplorthods, sandy	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
221B*: Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
221C*: Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
221D*, 221E*: Entic Haplorthods, sandy	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
222B*: Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Poor: seepage, too sandy.
222C*: Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, wetness.	Severe: seepage.	Poor: seepage, too sandy.
223B*: Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
223C*--------------- Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
223D*, 223E*-------- Entic Haplorthods, sandy	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
224B*--------------- Entic Haplorthods, sandy	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
225B*--------------- Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
225C*--------------- Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
225D*--------------- Entic Haplorthods, sandy	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
230B*--------------- Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
230C*--------------- Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
230D*, 230E*-------- Entic Haplorthods, sandy	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
231B*:					
Entic Haplorthods, sandy-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alfic Haplorthods, sandy over loamy--	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
233B*:					
Alfic Haplorthods, sandy over loamy--	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Entic Haplorthods, sandy-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
233C*:					
Alfic Haplorthods, sandy over loamy--	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Entic Haplorthods, sandy-------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
233D*, 233E*:					
Alfic Haplorthods, sandy over loamy--	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Entic Haplorthods, sandy-------------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
235B*:					
Alfic Haplorthods, sandy over loamy--	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alfic Haplorthods, sandy-------------	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
235C*:					
Alfic Haplorthods, sandy over loamy--	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Alfic Haplorthods, sandy-------------	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
240C*--------------- Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
241B*--------------- Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
245B*--------------- Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
245C*--------------- Entic Haplorthods, sandy	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
245D*: Entic Haplorthods, sandy	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
250*:					
Mollic Psammaquents	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, ponding.
Aquic Udipsamments	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
Medisaprists, euic	Severe: flooding, ponding.	Severe: flooding, excess humus, ponding.	Severe: flooding, ponding, excess humus.	Severe: flooding, ponding.	Poor: ponding, excess humus.
262A*: Aeric Haplaquods, sandy, ortstein	Severe: cemented pan, wetness, percs slowly.	Severe: seepage, cemented pan, wetness.	Severe: seepage, wetness, too sandy.	Severe: cemented pan, seepage, wetness.	Poor: cemented pan, seepage, too sandy.
263A*: Aquic Udipsamments	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
272*: Typic Haplaquods, sandy	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
273*: Mollic Psammaquents	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
274*: Typic Haplaquolls, sandy over loamy	Severe: ponding, percs slowly, poor filter.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
280*:					
Aquents	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Histosols	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.
281: Medisaprists, dysic	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
282----------------- Medisaprists, euic	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
10B, 10C Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
10D Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
10E Perrinton	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
11A Ithaca	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
12 Bono	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
13B Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
13C Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
13D Marlette	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
14B Capac	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, area reclaim.
16B Remus	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
16C Remus	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
16D Remus	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
17B*:				
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
17B*:				
Fern	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
17C*:				
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Fern	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
17D*:				
Marlette	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Fern	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
18B*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Gowdy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
18C*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: slope: too sandy.
Gowdy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
18D*:				
Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Gowdy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
20B*, 20C*:				
Arkport	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Chelsea	Good	Probable	Improbable: too sandy.	Poor: too sandy.
20D*:				
Arkport	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
20D*:				
Chelsea	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
21A Freesoil	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
22B, 22C Gowdy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
23A Arkona	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
24 Sickles	Poor: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, wetness.
25B*, 25C*:				
Gowdy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
25D*:				
Gowdy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
25E*:				
Gowdy	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
Perrinton	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
26A*:				
Arkona	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Ithaca	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
27B*:				
Arkona	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
27B*:				
Del Rey	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
28B, 28C Fern	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
28D Fern	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
29A Dixboro	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
30 Lamson	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
35B*:				
Alvin	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
35C*:				
Alvin	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
35D*:				
Alvin	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
36A Del Rey	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
37A Altmar	Fair: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
38B*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Okee	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
38C*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
Okee	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
38D*:				
Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Okee	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
38E*:				
Spinks	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
Okee	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
40B*, 40C*:				
Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
Toogood	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
40D*:				
Coloma	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
Toogood	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
41 Granby	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
42B*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
42B*:				
Remus	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Fern	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
42C*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
Remus	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Fern	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
42D*:				
Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Remus	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Fern	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
42E*:				
Spinks	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
Remus	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Fern	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
43B Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
43C Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
43D Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
43E Spinks	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
44B Thetford	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
45B*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Benona	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
45C*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
Benona	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
45D*:				
Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Benona	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
45E*, 45F*:				
Spinks	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
Benona	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
46B Grattan	Good	Probable	Improbable: too sandy.	Poor: too sandy.
48A*:				
Saugatuck	Poor: wetness.	Probable	Improbable: too sandy.	Poor: cemented pan, area reclaim, too sandy.
Jebavy	Poor: wetness.	Probable	Improbable: too sandy.	Poor: cemented pan, too sandy, wetness.
49B, 49B3, 49C, 49C3 Grattan	Good	Probable	Improbable: too sandy.	Poor: too sandy.
49E, 49F Grattan	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
50B Covert	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
51B Pipestone	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
52 Granby	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
53B, 53C Grattan	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
56B, 56C Benona	Good	Probable	Improbable: too sandy.	Poor: too sandy.
56E Benona	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
57C Nordhouse	Good	Probable	Improbable: too sandy.	Poor: too sandy.
57F Nordhouse	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
58 Kingsville	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
59B, 59C Benona	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
59E Benona	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
60B, 60C Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
60E Coloma	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
61B, 61C Epworth	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
61E Epworth	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
62B, 62C Plainfield	Good	Probable	Improbable: too sandy.	Poor: too sandy.
65 Sloan	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
67-------------------- Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
69-------------------- Algansee	Fair: wetness.	Probable-------------	Improbable: too sandy.	Poor: too sandy.
70-------------------- Glendora	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: too sandy, wetness.
71*:				
Houghton-------------	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
Carlisle-------------	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
72-------------------- Adrian	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: excess humus, wetness.
73-------------------- Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
75-------------------- Martisco	Poor: thin layer, wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
77-------------------- Napoleon	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness, too acid.
83*:				
Histosols------------	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Aquents--------------	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
84F*: Dune land.				
Quartzipsamments-----	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
Psammaquents---------	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: too sandy, wetness.
85F*: Udorthents-----------	Variable-------------	Variable-------------	Variable-------------	Variable.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
85F*:				
Quartzipsamments-----	Poor: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
86F*: Dune land.				
Quartzipsamments-----	Poor: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
87. Beaches				
88A------------------- Udipsamments	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
89A------------------- Udorthents	Variable-------------	Variable-------------	Variable-------------	Variable.
91. Pits, sand and gravel				
92B, 92C-------------- Chelsea	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
96B*:				
Spinks----------------	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy.
Tekenink--------------	Good-----------------	Improable: excess fines.	Improbable: excess fines.	Poor: small stones.
96C*:				
Spinks----------------	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: slope, too sandy.
Tekenink--------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
96D*:				
Spinks----------------	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: slope.
Tekenink--------------	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
96E*:				
Spinks----------------	Poor: slope.	Probable-------------	Improbable: too sandy.	Poor: slope.
Tekenink--------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
97*:				
Kerston	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Carlisle	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
98B*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Scalley	Good	Probable	Improbable: too sandy.	Poor: small stones, area reclaim.
98C*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
Scalley	Good	Probable	Improbable: too sandy.	Poor: small stones, area reclaim.
98D*:				
Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Scalley	Fair: slope.	Probable	Improbable: too sandy.	Poor: small stones, area reclaim, slope.
99B*:				
Nappanee	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Hoytville	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
100B Nappanee	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
101B, 101C Claybanks	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
210B*, 210C* Typic Udipsamments	Good	Probable	Improbable: too sandy.	Poor: too sandy.
210D* Typic Udipsamments	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
211B* Typic Udipsamments	Good	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
211C*: Typic Udipsamments	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
212B*: Typic Udipsamments	Good	Probable	Improbable: too sandy.	Poor: too sandy.
213B*, 213C*: Argic Udipsamments	Good	Probable	Improbable: too sandy.	Poor: too sandy.
213D*: Argic Udipsamments		Probable	Improbable: too sandy.	Poor: too sandy, slope.
220B*, 220C*: Entic Haplorthods, sandy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
220D*: Entic Haplorthods, sandy	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
220E*: Entic Haplorthods, sandy	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
221B*, 221C*: Entic Haplorthods, sandy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
221D*: Entic Haplorthods, sandy	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
221E*: Entic Haplorthods, sandy	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
222B*, 222C*, 223B*, 223C*: Entic Haplorthods, sandy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
223D*: Entic Haplorthods, sandy	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
223E*: Entic Haplorthods, sandy	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
224B*: Entic Haplorthods, sandy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
225B*, 225C*: Entic Haplorthods, sandy	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
225D*: Entic Haplorthods, sandy	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
230B*, 230C*: Entic Haplorthods, sandy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
230D*: Entic Haplorthods, sandy	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
230E*: Entic Haplorthods, sandy	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
231B*:				
Entic Haplorthods, sandy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Alfic Haplorthods, sandy over loamy	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
233B*, 233C*:				
Alfic Haplorthods, sandy over loamy	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Entic Haplorthods, sandy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
233D*:				
Alfic Haplorthods, sandy over loamy	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
Entic Haplorthods, sandy	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
233E*:				
Alfic Haplorthods, sandy over loamy	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
Entic Haplorthods, sandy	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
235B*:				
Alfic Haplorthods, sandy over loamy	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
235B*:				
Alfic Haplorthods, sandy	Fair: thin layer.	Probable	Improbable: too sandy.	Poor: too sandy.
235C*:				
Alfic Haplorthods, sandy over loamy	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Alfic Haplorthods, sandy	Fair: thin layer.	Probable	Improbable: too sandy.	Poor: too sandy.
240C*, 241B* Entic Haplorthods, sandy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
245B*, 245C* Entic Haplorthods, sandy	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
245D* Entic Haplorthods, sandy	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
250*:				
Mollic Psammaquents	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Aquic Udipsamments	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Medisaprists, euic	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
262A* Aeric Haplaquods, sandy, ortstein	Poor: wetness.	Probable	Improbable: too sandy.	Poor: cemented pan, area reclaim, too sandy.
263A* Aquic Udipsamments	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
272* Typic Haplaquods, sandy	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
273* Mollic Psammaquents	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
274* Typic Haplaquolls, sandy over loamy	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
280*:				
Aquents--------------	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Histosols------------	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
281------------------- Medisaprists, dysic	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
282------------------- Medisaprists, euic	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
10B--------------- Perrinton	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly.	Erodes easily, percs slowly.
10C, 10D, 10E----- Perrinton	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, erodes easily, percs slowly.
11A--------------- Ithaca	Slight---------	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness--------	Wetness, percs slowly.
12---------------- Bono	Slight---------	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
13B--------------- Marlette	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, soil blowing, rooting depth.	Rooting depth.
13C, 13D---------- Marlette	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, soil blowing, rooting depth.	Slope, rooting depth.
14B--------------- Capac	Slight---------	Severe: piping, wetness.	Severe: slow refill.	Frost action---	Wetness, soil blowing.	Wetness.
16B--------------- Remus	Moderate: slope.	Slight---------	Severe: no water.	Deep to water	Slope, droughty.	Droughty, rooting depth.
16C, 16D---------- Remus	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, droughty.	Slope, droughty, rooting depth.
17B*:						
Marlette---------	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, soil blowing, rooting depth.	Rooting depth.
Fern-------------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
17C*, 17D*:						
Marlette---------	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, soil blowing, rooting depth.	Slope, rooting depth.
Fern-------------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
18B*:						
Spinks-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
18B*:						
Gowdy	Severe: seepage.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
18C*, 18D*:						
Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Gowdy	Severe: seepage, slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
20B*:						
Arkport	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Droughty, fast intake, slope.	Droughty.
Chelsea	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
20C*:						
Arkport	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Droughty, fast intake, slope.	Slope, droughty.
Chelsea	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
20D*:						
Arkport	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Droughty, fast intake, slope.	Slope, droughty.
Chelsea	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
21A Freesoil	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, droughty.
22B Gowdy	Severe: seepage.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
22C Gowdy	Severe: seepage, slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
23A Arkona	Severe: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly	Wetness, droughty.	Wetness, droughty, rooting depth.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
24---------------- Sickles	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, percs slowly, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty, rooting depth.
25B*:						
Gowdy------------	Severe: seepage.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
Perrinton--------	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly.	Erodes easily, percs slowly.
25C*, 25D*, 25E*:						
Gowdy------------	Severe: seepage, slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
Perrinton--------	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, erodes easily, percs slowly.
26A*:						
Arkona-----------	Severe: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness, droughty.	Wetness, droughty, rooting depth.
Ithaca-----------	Slight---------	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness--------	Wetness, percs slowly.
27B*:						
Arkona-----------	Severe: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness, droughty.	Wetness, droughty, rooting depth.
Del Rey----------	Slight---------	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.
28B--------------- Fern	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
28C, 28D---------- Fern	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
29A--------------- Dixboro	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, fast intake.	Wetness.
30---------------- Lamson	Severe: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding, soil blowing.	Wetness.
35B*:						
Alvin------------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Favorable.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
35B*:						
Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
35C*, 35D*:						
Alvin	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
36A Del Rey	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.
37A Altmar	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
38B*:						
Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Okee	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
38C*, 38D*, 38E*:						
Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Okee	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
40B*:						
Coloma	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Toogood	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
40C*, 40D*:						
Coloma	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Toogood	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
41---------------- Granby	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
42B*:						
Spinks-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Remus------------	Moderate: slope.	Slight---------	Severe: no water.	Deep to water	Slope, droughty.	Droughty, rooting depth.
Fern-------------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
42C*, 42D*, 42E*:						
Spinks-----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Remus------------	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, droughty.	Slope, droughty, rooting depth.
Fern-------------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
43B--------------- Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
43C, 43D, 43E----- Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
44B--------------- Thetford	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
45B*:						
Spinks-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Benona-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
45C*, 45D*, 45E*, 45F*:						
Spinks----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Benona----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
46B---------------- Grattan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
48A*:						
Saugatuck---------	Severe: seepage, cemented pan.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cemented pan, cutbanks cave.	Wetness, droughty.	Wetness, droughty, cemented pan.
Jebavy------------	Severe: seepage, cemented pan.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cemented pan, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty, cemented pan.
49B, 49B3--------- Grattan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
49C, 49C3, 49E, 49F-------------- Grattan	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
50B---------------- Covert	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Slope, cutbanks cave.	Slope, wetness, droughty.	Droughty.
51B---------------- Pipestone	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
52----------------- Granby	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
53B---------------- Grattan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
53C---------------- Grattan	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
56B---------------- Benona	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
56C, 56E---------- Benona	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
57C, 57F---------- Nordhouse	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
58---------------- Kingsville	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
59B--------------- Benona	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
59C, 59E---------- Benona	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
60B--------------- Coloma	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
60C, 60E---------- Coloma	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
61B--------------- Epworth	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty, rooting depth.
61C, 61E---------- Epworth	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty, rooting depth.
62B--------------- Plainfield	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
62C--------------- Plainfield	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
65---------------- Sloan	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness, erodes easily.
67---------------- Cohoctah	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, flooding.	Wetness.
69---------------- Algansee	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, droughty.
70---------------- Glendora	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, flooding.	Wetness, droughty.
71*:						
Houghton----------	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Ponding--------	Wetness.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
71*:						
Carlisle	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
72 Adrian	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing, rooting depth.	Wetness, rooting depth.
73 Palms	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness, erodes easily, rooting depth.
75 Martisco	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
77 Napoleon	Severe: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing, too acid.	Wetness.
83*:						
Histosols	Slight	Severe: excess humus, ponding.	Slight	Ponding, frost action.	Ponding	Wetness.
Aquents	Slight	Severe: ponding.	Slight	Ponding, frost action.	Ponding	Wetness.
84F*:						
Dune land.						
Quartzipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Psammaquents	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, slope, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
85F*:						
Udorthents	Variable	Variable	Variable	Variable	Variable	Variable.
Quartzipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
86F*:						
Dune land.						
Quartzipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
87. Beaches						

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
88A--------------- Udipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake.	Droughty.
89A--------------- Udorthents	Variable-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable.
91. Pits, sand and gravel						
92B--------------- Chelsea	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
92C--------------- Chelsea	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
96B*:						
Spinks-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Tekenink---------	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
96C*, 96D*, 96E*:						
Spinks-----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Tekenink---------	Severe: slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
97*:						
Kerston----------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, flooding, subsides.	Ponding, soil blowing, flooding.	Wetness.
Carlisle---------	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, flooding, subsides.	Ponding, soil blowing, flooding.	Wetness.
98B*:						
Spinks-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Scalley----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, fast intake.	Favorable.
98C*, 98D*:						
Spinks-----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
98C*, 98D*:						
Scalley	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, fast intake.	Slope.
99B*:						
Nappanee	Slight	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly	Wetness, droughty.	Wetness, erodes easily.
Hoytville	Slight	Severe: hard to pack, ponding.	Severe: no water.	Ponding, frost action.	Ponding, percs slowly.	Wetness, rooting depth.
100B Nappanee	Slight	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly	Wetness, droughty.	Wetness, erodes easily.
101B Claybanks	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly, rooting depth.	Erodes easily, rooting depth.
101C Claybanks	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly, rooting depth.	Slope, erodes easily, rooting depth.
210B* Typic Udipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
210C*, 210D* Typic Udipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
211B* Typic Udipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
211C* Typic Udipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
212B* Typic Udipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
213B* Argic Udipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
213C*, 213D* Argic Udipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
220B* Entic Haplorthods, sandy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
220C*, 220D*, 220E*------------ Entic Haplorthods, sandy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
221B*------------- Entic Haplorthods, sandy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
221C*, 221D*, 221E*------------ Entic Haplorthods, sandy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
222B*------------- Entic Haplorthods, sandy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
222C*------------- Entic Haplorthods, sandy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
223B*------------- Entic Haplorthods, sandy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
223C*, 223D*, 223E*------------ Entic Haplorthods, sandy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
224B*------------- Entic Haplorthods, sandy	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Slope, droughty, fast intake.	Droughty.
225B*------------- Entic Haplorthods, sandy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
225C*, 225D*------ Entic Haplorthods, sandy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
230B*------------- Entic Haplorthods, sandy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
230C*, 230D*, 230E*------------ Entic Haplorthods, sandy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
231B*:						
Entic Haplorthods, sandy-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Alfic Haplorthods, sandy over loamy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
233B*:						
Alfic Haplorthods, sandy over loamy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
Entic Haplorthods, sandy-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
233C*, 233D*, 233E*:						
Alfic Haplorthods, sandy over loamy----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
Entic Haplorthods, sandy----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
235B*:						
Alfic Haplorthods, sandy over loamy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
Alfic Haplorthods, sandy-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
235C*:						
Alfic Haplorthods, sandy over loamy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
Alfic Haplorthods, sandy----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
240C*------------- Entic Haplorthods, sandy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
241B*------------- Entic Haplorthods, sandy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
245B*------------- Entic Haplorthods, sandy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
245C*, 245D*------ Entic Haplorthods, sandy	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
250*:						
Mollic Psammaquents----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, flooding, cutbanks cave.	Ponding, droughty, flooding.	Wetness, droughty.
Aquic Udipsamments----	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Droughty.
Medisaprists, euic------------	Slight---------	Severe: excess humus, ponding.	Slight---------	Ponding, flooding, frost action.	Ponding, soil blowing, flooding.	Wetness.
262A*------------- Aeric Haplaquods, sandy, ortstein	Severe: seepage, cemented pan.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Cemented pan, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, droughty, cemented pan.
263A*------------- Aquic Udipsamments	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
272*: Typic Haplaquods, sandy	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
273*: Mollic Psammaquents	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty.	Wetness, droughty.
274*: Typic Haplaquolls, sandy over loamy	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Ponding, soil blowing.	Wetness, erodes easily.
280*:						
Aquents	Slight	Severe: ponding.	Slight	Ponding, frost action.	Ponding	Wetness.
Histosols	Slight	Severe: excess humus, ponding.	Slight	Ponding, frost action.	Ponding, soil blowing.	Wetness.
281: Medisaprists, dysic	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding, soil blowing.	Wetness.
282: Medisaprists, euic	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding, soil blowing.	Wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
10B, 10C, 10D, 10E------------- Perrinton	0-9	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-100	50-90	20-35	4-15
	9-18	Fine sandy loam, clay loam, silty clay loam.	SC, CL-ML, CL, SC-SM	A-2-4, A-4, A-6, A-7 A-6, A-7	0-5	95-100	85-100	50-100	25-90	20-60	4-35
	18-35	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0-5	95-100	85-100	80-100	60-90	40-60	20-35
	35-60	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0-5	95-100	85-100	75-100	55-90	35-60	15-35
11A-------------- Ithaca	0-9	Loam-------------	CL, CL-ML	A-4, A-6	0-3	95-100	85-100	70-95	50-75	20-35	4-15
	9-13	Fine sandy loam, clay loam, silty clay loam.	SC, CL	A-4, A-6, A-7-6	0-3	95-100	85-100	55-100	35-95	25-50	7-30
	13-24	Clay loam, silty clay loam.	CL, CH	A-7	0-3	95-100	85-100	85-100	60-90	40-55	20-30
	24-60	Clay loam, silty clay loam.	CL, CH	A-7	0-3	95-100	85-100	85-100	60-90	40-55	20-30
12--------------- Bono	0-11	Silt loam--------	CL	A-7, A-6	0	95-100	95-100	90-100	70-95	25-45	10-25
	11-32	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	95-100	95-100	90-100	40-66	26-44
	32-60	Clay, silty clay loam, silty clay.	CH, CL	A-7, A-6	0	100	95-100	95-100	90-100	35-60	20-40
13B, 13C, 13D---- Marlette	0-8	Fine sandy loam	SC-SM, SC	A-4, A-2-4	0-5	95-100	85-95	50-70	30-50	20-30	4-10
	8-12	Fine sandy loam, clay loam, silty clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6, A-7, A-2-4	0-5	95-100	85-95	50-95	30-90	20-45	4-25
	12-25	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	85-95	80-95	55-90	30-45	11-25
	25-60	Silty clay loam, clay loam.	CL	A-4, A-6	0-5	95-100	85-95	75-95	50-75	25-40	7-20
14B-------------- Capac	0-9	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4, A-2	0-5	95-100	85-100	50-85	30-55	<25	NP-7
	9-36	Fine sandy loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	75-100	50-85	25-45	5-20
	36-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	75-100	70-95	55-75	20-45	5-20
16B, 16C, 16D---- Remus	0-9	Fine sandy loam	SM, SC-SM	A-2, A-4	0-10	85-100	85-95	55-75	25-45	<25	NP-7
	9-21	Loam, loamy sand, fine sandy loam.	SM, SC-SM	A-2, A-4, A-1-b	0-10	85-100	85-95	45-75	15-45	<25	NP-7
	21-50	Sandy loam, sandy clay loam, loam.	SC, CL	A-2, A-6	0-10	85-100	85-95	45-80	10-65	20-30	10-15
	50-60	Sandy loam, sandy clay loam.	SC	A-2, A-6	0-10	85-100	85-95	55-80	25-45	25-40	10-20

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17B*, 17C*, 17D*:											
Marlette--------	0-8	Fine sandy loam	SC-SM, SC	A-4, A-2-4	0-5	95-100	85-95	50-70	30-50	20-30	4-10
	8-12	Fine sandy loam, clay loam, silty clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6, A-7, A-2-4	0-5	95-100	85-95	50-95	30-90	20-45	4-25
	12-25	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	85-95	80-95	55-90	30-45	11-25
	25-60	Silty clay loam, clay loam.	CL	A-4, A-6	0-5	95-100	85-95	75-95	50-75	25-40	7-20
Fern------------	0-10	Loamy fine sand	SM	A-4, A-2-4	0	95-100	85-100	75-95	30-50	<20	NP
	10-21	Loamy sand, fine sand, loamy fine sand.	SP-SM, SM, SC-SM	A-1-b, A-3, A-2-4	0	95-100	85-100	40-90	5-50	<25	NP-6
	21-51	Loamy sand, loamy fine sand, loam.	SP-SM, CL, ML, SC	A-4, A-2-4, A-6	0	95-100	85-100	40-95	10-70	20-40	2-20
	51-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	85-100	70-95	50-80	20-40	4-20
18B*, 18C*, 18D*:											
Spinks----------	0-9	Loamy fine sand	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	9-24	Sand, fine sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	24-60	Fine sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
Gowdy-----------	0-9	Loamy fine sand	SM	A-2	0	95-100	95-100	60-100	15-25	---	NP
	9-28	Fine sand, sand	SM, SP-SM	A-2, A-3	0	95-100	95-100	50-100	5-35	---	NP
	28-32	Silty clay, silty clay loam, fine sandy loam.	CL, CL-ML	A-4, A-6, A-7	0	90-100	95-100	80-100	50-95	25-50	9-30
	32-42	Silty clay loam, silty clay, clay.	CH, CL	A-7	0	90-100	90-100	85-100	65-100	40-65	20-50
	42-60	Silty clay loam	CL	A-6, A-7	0	90-100	90-100	95-100	85-95	40-45	16-20
20B*, 20C*, 20D*:											
Arkport---------	0-8	Loamy very fine sand.	SM	A-2, A-4	0	95-100	95-100	65-85	20-45	---	NP
	8-22	Very fine sand, loamy very fine sand.	SM, ML	A-2, A-4	0	95-100	95-100	70-95	30-65	<15	NP-4
	22-60	Very fine sand, loamy very fine sand, very fine sandy loam.	SM, ML	A-2, A-4	0	95-100	95-100	65-95	20-80	---	NP
Chelsea---------	0-9	Fine sand--------	SP, SP-SM, SM	A-3, A-2-4	0	100	100	65-95	3-15	---	NP
	9-60	Fine sand, loamy fine sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
21A-------------- Freesoil	0-9	Loamy very fine sand.	SM, SC-SM, ML, CL-ML	A-4	0	100	100	90-95	40-60	<25	NP-7
	9-24	Stratified fine sand to silt loam.	SM, SC, ML, CL	A-4, A-2-4, A-2-6	0	100	100	65-100	20-80	<30	NP-11
	24-60	Stratified fine sand to silty clay loam.	SM, ML	A-4, A-2, A-6	0	100	100	65-100	20-90	<45	NP-18
22B, 22C--------- Gowdy	0-9	Loamy fine sand	SM	A-2	0	95-100	95-100	60-100	15-25	---	NP
	9-28	Fine sand, sand	SM, SP-SM	A-2, A-3	0	95-100	95-100	50-100	5-35	---	NP
	28-32	Silty clay, silty clay loam, fine sandy loam.	CL, CL-ML	A-4, A-6, A-7	0	90-100	95-100	80-100	50-95	25-50	9-30
	32-42	Silty clay loam, silty clay, clay.	CH, CL	A-7	0	90-100	90-100	85-100	65-100	40-65	20-50
	42-60	Silty clay loam	CL	A-6, A-7	0	90-100	90-100	95-100	85-95	40-45	16-20
23A-------------- Arkona	0-7	Loamy fine sand	SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-80	10-35	---	NP
	7-31	Sand, loamy sand, fine sand.	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-80	5-35	---	NP
	31-60	Silty clay, silty clay loam.	CH	A-7	0	95-100	90-100	85-100	75-95	50-70	25-40
24--------------- Sickles	0-9	Loamy sand-------	SM, SP-SM, SC-SM	A-2-4	0	95-100	90-100	50-75	10-30	<20	NP-6
	9-32	Sand, loamy sand, fine sand.	SP-SM, SM, SC-SM	A-3, A-2-4	0	95-100	90-100	50-75	5-30	<25	NP-6
	32-60	Silty clay loam, silty clay.	CH, CL	A-7	0	95-100	90-100	90-100	75-95	42-60	29-40
25B*, 25C*, 25D*, 25E*:											
Gowdy-----------	0-9	Loamy fine sand	SM	A-2	0	95-100	95-100	60-100	15-25	---	NP
	9-28	Fine sand, sand	SM, SP-SM	A-2, A-3	0	95-100	95-100	50-100	5-35	---	NP
	28-32	Silty clay, silty clay loam, fine sandy loam.	CL, CL-ML	A-4, A-6, A-7	0	90-100	95-100	80-100	50-95	25-50	9-30
	32-42	Silty clay loam, silty clay, clay.	CH, CL	A-7	0	90-100	90-100	85-100	65-100	40-65	20-50
	42-60	Silty clay loam	CL	A-6, A-7	0	90-100	90-100	95-100	85-95	40-45	16-20
Perrinton------	0-9	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-100	50-90	20-35	4-15
	9-18	Fine sandy loam, clay loam, silty clay loam.	SC, CL-ML, CL, SC-SM	A-2-4, A-4, A-6, A-7	0-5	95-100	85-100	50-100	25-90	20-60	4-35
	18-35	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0-5	95-100	85-100	80-100	60-90	40-60	20-35
	35-60	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0-5	95-100	85-100	75-100	55-90	35-60	15-35

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
26A*:											
Arkona	0-7	Loamy sand	SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-80	10-35	---	NP
	7-31	Sand, loamy sand, fine sand.	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-80	5-35	---	NP
	31-60	Silty clay, silty clay loam.	CH	A-7	0	95-100	90-100	85-100	75-95	50-70	25-40
Ithaca	0-9	Loam	CL, CL-ML	A-4, A-6	0-3	95-100	85-100	70-95	50-75	20-35	4-15
	9-13	Fine sandy loam, clay loam, silty clay loam.	SC, CL	A-4, A-6, A-7-6	0-3	95-100	85-100	55-100	35-95	25-50	7-30
	13-24	Clay loam, silty clay loam.	CL, CH	A-7	0-3	95-100	85-100	85-100	60-90	40-55	20-30
	24-60	Clay loam, silty clay loam.	CL, CH	A-7	0-3	95-100	85-100	85-100	60-90	40-55	20-30
27B*:											
Arkona	0-7	Loamy sand	SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-80	10-35	---	NP
	7-31	Sand, loamy sand, fine sand.	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-80	5-35	---	NP
	31-60	Silty clay, silty clay loam.	CH	A-7	0	95-100	90-100	85-100	75-95	50-70	25-40
Del Rey	0-8	Silt loam	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	25-45	10-25
	8-32	Silty clay loam, silty clay.	CH, CL	A-7	0	95-100	95-100	90-100	85-95	40-55	20-30
	32-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-45	10-25
28B, 28C, 28D Fern	0-10	Loamy fine sand	SM	A-4, A-2-4	0	95-100	85-100	75-95	30-50	<20	NP
	10-21	Loamy sand, fine sand, loamy fine sand.	SP-SM, SM, SC-SM	A-1-b, A-3, A-2-4	0	95-100	85-100	40-90	5-50	<25	NP-6
	21-51	Loamy sand, loamy fine sand, loam.	SP-SM, CL, ML, SC	A-4, A-2-4, A-6	0	95-100	85-100	40-95	10-70	20-40	2-20
	51-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	85-100	70-95	50-80	20-40	4-20
29A Dixboro	0-9	Loamy very fine sand.	SM, ML, SC-SM, CL-ML	A-2-4, A-4	0	100	100	70-95	20-60	<25	NP-6
	9-24	Very fine sandy loam, silt loam, loamy very fine sand.	SM, ML, SC, CL	A-4	0	100	100	70-95	40-90	<25	2-10
	24-60	Stratified fine sand to silt loam.	SM, ML, SC, CL	A-2-4, A-4	0	100	95-100	70-95	20-80	<20	NP-8
30 Lamson	0-7	Muck	PT	A-8	0	---	---	---	---	---	---
	7-80	Fine sand, loamy very fine sand, silt loam.	SM, ML	A-2, A-4	0	95-100	80-100	60-90	20-90	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	 AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	 10	 40	 200	Liquid limit	Plasticity index
	In				Pct					Pct	
35B*, 35C*, 35D*:											
Alvin-----------	0-8	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	80-95	30-60	<25	NP-4
	8-15	Fine sandy loam, sandy loam, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	80-95	30-60	<25	NP-4
	15-22	Fine sandy loam, sandy loam, loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	100	100	70-100	20-80	15-40	NP-15
	22-80	Sand, fine sandy loam, loamy sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	90-100	45-95	4-35	<20	NP-4
Spinks----------	0-9	Loamy fine sand	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	9-24	Sand, fine sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	24-80	Fine sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
36A--------------	0-8	Silt loam--------	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	25-45	10-25
Del Rey	8-32	Silty clay loam, silty clay.	CH, CL	A-7	0	95-100	95-100	90-100	85-95	40-55	20-30
	32-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-45	10-25
37A--------------	0-9	Loamy fine sand	SM, SW-SM, SP-SM	A-2, A-4, A-1	0-2	80-100	75-100	40-80	10-45	<15	NP-1
Altmar	9-24	Loamy sand, sand	SP, SP-SM, SM	A-3, A-2-4, A-1	0-5	95-100	85-100	45-75	0-30	<15	NP-1
	24-60	Gravelly sand----	SP, GP, SP-SM, GP-GM	A-1	0-5	40-80	35-70	20-45	0-10	---	NP
38B*, 38C*, 38D*, 38E*:											
Spinks---------	0-9	Loamy fine sand	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	9-24	Sand, fine sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	24-60	Fine sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
Okee-----------	0-3	Loamy sand-------	SM, SP-SM	A-2, A-4, A-1-b	0-10	95-100	90-100	45-85	10-40	---	NP
	3-25	Loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3, A-4, A-1-b	0-10	95-100	90-100	45-85	3-40	---	NP
	25-33	Sandy clay loam, sandy loam, gravelly sandy loam.	SC, SM, ML, CL	A-2, A-4	0-10	95-100	90-100	35-80	20-55	<25	2-10
	33-60	Sand, very gravelly sand.	SM, SP-SM, GM, GP-GM	A-2, A-4, A-3, A-1-b	0-15	45-95	40-95	10-75	2-40	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
40B*, 40C*, 40D*:											
Coloma----------	0-4	Sand-------------	SP, SM, SP-SM	A-2, A-3	0-7	75-100	75-100	50-70	2-15	---	NP
	4-35	Sand-------------	SP, SM, SP-SM	A-2, A-3	0-7	75-100	75-100	50-75	2-30	---	NP
	35-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-7	75-100	75-100	50-100	2-40	---	NP
Toogood---------	0-4	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0-5	85-100	75-100	35-75	10-30	<20	NP-5
	4-36	Loamy sand, sand	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0-5	95-100	85-100	35-75	10-30	<20	NP-5
	36-38	Gravelly sandy loam, loamy sand, gravelly loamy sand.	SC, SC-SM	A-1-b, A-2-4	0-5	80-85	70-75	40-55	20-35	20-30	5-10
	38-60	Gravelly coarse sand, gravelly sand.	GP-GM, GP, SP-SM, SP	A-1-A, A-1-b	0-5	40-70	30-60	15-45	0-15	<20	NP
41--------------- Granby	0-10	Mucky loamy sand	SM	A-2-4	0	100	100	50-75	15-30	---	NP
	10-28	Sand, fine sand, loamy sand.	SP-SM, SM	A-3, A-2, A-1	0	100	95-100	45-80	5-35	---	NP
	28-60	Sand-------------	SP-SM, SM	A-3, A-2, A-1	0	100	95-100	45-80	5-35	---	NP
42B*, 42C*, 42D*, 42E*:											
Spinks---------	0-9	Loamy fine sand	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	9-24	Sand, fine sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	24-60	Fine sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	75-100	40-90	10-35	<25	NP-7
Remus----------	0-9	Fine sandy loam	SM, SC-SM	A-2, A-4	0-10	85-100	85-95	55-75	25-45	<25	NP-7
	9-21	Loam, loamy sand, fine sandy loam.	SM, SC-SM	A-2, A-4, A-1-b	0-10	85-100	85-95	45-75	15-45	<25	NP-7
	21-38	Sandy loam, sandy clay loam, loam.	SC, SP-SC, CL	A-2, A-6	0-10	85-100	85-95	45-80	10-65	20-30	10-15
	38-60	Sandy loam, sandy clay loam.	SC	A-2, A-6	0-10	85-100	85-95	55-80	25-45	25-40	10-20
Fern-----------	0-10	Loamy fine sand	SM	A-4, A-2-4	0	95-100	85-100	75-95	30-50	<20	NP
	10-21	Loamy sand, fine sand, loamy fine sand.	SP-SM, SM, SC-SM	A-1-b, A-3, A-2-4	0	95-100	85-100	40-90	5-50	<25	NP-6
	21-51	Loamy sand, loamy fine sand, loam.	SP-SM, CL, ML, SC	A-4, A-2-4, A-6	0	95-100	85-100	40-95	10-70	20-40	2-20
	51-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	85-100	70-95	50-80	20-40	4-20

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
43B, 43C, 43D, 43E------------- Spinks	0-9	Loamy fine sand	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	9-24	Sand, fine sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	24-60	Fine sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
44B-------------- Thetford	0-9	Loamy fine sand	SM, SC-SM, SP-SM	A-2, A-4, A-1-b	0	95-100	90-100	45-80	10-45	<25	NP-7
	9-24	Sand, loamy sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2, A-3, A-1-b	0	95-100	90-100	45-80	5-35	<25	NP-7
	24-54	Loamy sand, fine sandy loam, sand.	SM, SC-SM, SC	A-2, A-4	0	95-100	90-100	60-80	20-50	<30	NP-10
	54-60	Fine sand, sand	SM, SP, SP-SM	A-2, A-4, A-3	0	75-100	60-100	50-85	0-45	<20	NP-4
45B*, 45C*, 45D*, 45E*, 45F*: Spinks----------	0-9	Loamy fine sand	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	9-24	Sand, fine sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	24-60	Fine sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
Benona---------	0-8	Sand-------------	SP, SP-SM, SM	A-2, A-3, A-1	0-5	90-100	75-100	45-70	0-15	---	NP
	8-46	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0-5	90-100	75-100	45-90	0-30	---	NP
	46-60	Sand, loamy sand	SP-SM, SM	A-2, A-3, A-1	0-5	90-100	75-100	45-75	5-30	---	NP
46B-------------- Grattan	0-3	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	5-15	---	NP
	3-32	Sand-------------	SM, SP-SM, SP	A-2-4, A-1-b, A-3	0	95-100	90-100	45-70	3-15	---	NP
	32-60	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
48A*: Saugatuck-------	0-3	Fine sand--------	SP-SM, SM	A-3, A-2-4	0	100	100	50-70	5-20	---	NP
	3-7	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	100	100	80-95	5-30	---	NP
	7-29	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	100	100	80-95	5-30	---	NP
	29-60	Sand, fine sand	SP, SP-SM, SM	A-3, A-2-4	0	100	100	80-95	0-30	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
48A*:											
Jebavy----------	0-4	Fine sand--------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	45-70	5-15	---	NP
	4-12	Sand, fine sand	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	90-100	45-95	5-30	---	NP
	12-16	Sand, fine sand	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	90-100	45-95	5-30	---	NP
	16-36	Sand, fine sand	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	90-100	45-95	5-30	---	NP
	36-60	Sand, fine sand	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	90-100	45-95	5-30	---	NP
49B-------------- Grattan	0-3	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	3-15	---	NP
	3-32	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-75	3-30	---	NP
	32-60	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
49B3------------- Grattan	0-22	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-75	3-30	---	NP
	22-60	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
49C-------------- Grattan	0-3	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	3-15	---	NP
	3-32	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-75	3-30	---	NP
	32-60	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
49C3------------- Grattan	0-22	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-75	3-30	---	NP
	22-60	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
49E, 49F--------- Grattan	0-3	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	3-15	---	NP
	3-32	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-75	3-30	---	NP
	32-60	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
50B-------------- Covert	0-1	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	1-33	Sand, loamy sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
	33-60	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
51B-------------- Pipestone	0-2	Fine sand--------	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-90	5-35	---	NP
	2-38	Sand, fine sand	SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-90	5-30	---	NP
	38-60	Sand, fine sand	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	85-100	40-90	5-30	---	NP
52--------------- Granby	0-11	Sand-------------	SP-SM, SM	A-3, A-2	0	100	100	50-80	5-35	---	NP
	11-28	Sand, fine sand, loamy sand.	SP-SM, SM	A-3, A-2, A-1	0	100	95-100	45-80	5-35	---	NP
	28-60	Sand-------------	SP-SM, SM	A-3, A-2, A-1	0	100	95-100	45-80	5-35	---	NP
53B, 53C--------- Grattan	0-9	Sand-------------	SM, SP-SM, SP	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	3-15	---	NP
	9-36	Sand-------------	SM, SP-SM, SP	A-2-4, A-3, A-1-b	0	95-100	90-100	45-75	3-30	---	NP
	36-48	Sand-------------	SP, SP-SM, SM	A-1-b, A-2-4, A-3	0	95-100	90-100	40-85	0-15	---	NP
	48-60	Clay loam--------	CL	A-6, A-7	0	95-100	90-100	70-90	50-80	35-45	15-25
56B, 56C, 56E---- Benona	0-8	Sand-------------	SP, SP-SM, SM	A-2, A-3, A-1	0	90-100	75-100	45-70	0-15	---	NP
	8-48	Sand-------------	SP, SP-SM, SM	A-2, A-3, A-1	0	90-100	75-100	45-70	0-15	---	NP
	48-87	Sand, loamy sand	SP-SM, SM	A-2, A-3, A-1	0	90-100	75-100	45-75	5-30	---	NP
	87-91	Clay loam--------	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	70-80	20-35	5-20
	91-99	Sand-------------	SP-SM, SM	A-2, A-3, A-1	0	90-100	75-100	45-75	5-30	---	NP
57C, 57F--------- Nordhouse	0-1	Fine sand--------	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	1-34	Fine sand--------	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	34-60	Fine sand--------	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
58--------------- Kingsville	0-7	Mucky sand-------	SM, SP-SM	A-2, A-1, A-3	0	100	90-100	45-70	5-15	---	NP
	7-24	Fine sand--------	SM, SP-SM	A-2, A-4	0	100	90-100	50-80	10-45	---	NP
	24-60	Fine sand, sand	SM, SW-SM, SP-SM	A-2, A-3, A-4, A-1	0	95-100	85-100	45-80	5-45	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
59B, 59C, 59E---- Benona	0-8	Sand-------------	SP, SP-SM, SM	A-2, A-3, A-1	0-5	90-100	75-100	45-70	0-15	---	NP
	8-46	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0-5	90-100	75-100	45-90	0-30	---	NP
	46-60	Sand, loamy sand	SP-SM, SM	A-2, A-3, A-1	0-5	90-100	75-100	45-75	5-30	---	NP
60B, 60C, 60E---- Coloma	0-4	Sand-------------	SP, SM, SP-SM	A-2, A-3	0-7	75-100	75-100	50-70	2-15	---	NP
	4-35	Sand-------------	SP, SM, SP-SM	A-2, A-3	0-7	75-100	75-100	50-75	2-30	---	NP
	35-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-7	75-100	75-100	50-100	2-40	---	NP
61B, 61C, 61E---- Epworth	0-1	Fine sand--------	SM	A-2-4	0	100	100	65-80	20-35	---	NP
	1-24	Fine sand--------	SM	A-2-4	0	100	100	65-80	20-35	---	NP
	24-60	Fine sand--------	SM	A-2-4	0	100	100	65-80	20-35	---	NP
62B, 62C--------- Plainfield	0-3	Sand-------------	SP-SM, SM, SP	A-3, A-2, A-1	0	75-100	75-100	40-80	3-35	---	NP
	3-30	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-70	1-15	---	NP
	30-60	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-90	1-15	---	NP
65--------------- Sloan	0-14	Silt loam--------	CL, ML, CL-ML	A-6, A-4	0	100	95-100	85-100	70-95	20-40	3-15
	14-32	Silty clay loam, clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	75-95	30-45	8-18
	32-60	Stratified loam to silty clay loam.	ML, CL	A-4, A-6	0	95-100	70-100	60-95	50-90	25-40	3-15
67--------------- Cohoctah	0-15	Fine sandy loam	ML, SM, SC, CL	A-4, A-2	0	100	100	60-95	30-65	<30	NP-10
	15-30	Loam, fine sandy loam, sandy loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	85-100	70-90	30-70	<30	NP-10
	30-80	Loam, silt loam, fine sandy loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	85-100	65-90	20-70	<30	NP-10
69--------------- Algansee	0-8	Loamy fine sand	SM, SC-SM	A-2-4	0	100	100	50-75	15-35	<25	NP-7
	8-60	Sand, fine sand	SM, SP-SM	A-3, A-2-4	0	100	100	50-80	5-35	---	NP
70--------------- Glendora	0-8	Mucky loamy fine sand.	SC-SM, SM, SP-SM	A-2-4, A-4, A-1	0-5	95-100	90-100	45-85	10-50	<25	NP-7
	8-60	Stratified sand to loamy fine sand.	SP-SM, SP, SM	A-3, A-2-4, A-1-b	0-5	95-100	90-100	45-85	0-35	---	NP
71*:											
Houghton--------	0-8	Mucky peat-------	PT	A-8	0	---	---	---	---	---	---
	8-60	Muck-------------	PT	A-8	0	---	---	---	---	---	---
Carlisle--------	0-60	Muck-------------	PT	A-8	0-30	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
72------------- Adrian	0-34	Muck------------	PT	A-8	---	---	---	---	---	---	---
	34-60	Sand, coarse sand	SP, SM	A-2, A-3, A-1	0	80-100	60-100	30-80	0-35	---	NP
73------------- Palms	0-10	Muck------------	PT	A-8	0	---	---	---	---	---	---
	10-18	Muck------------	PT	A-8	0	---	---	---	---	---	---
	18-60	Sandy loam, silt loam, silty clay loam.	CL-ML, CL, SC, SC-SM	A-4, A-6, A-7, A-2	0	85-100	60-100	35-95	15-90	20-45	5-20
75------------- Martisco	0-15	Muck------------	PT	A-8	0	---	---	---	---	---	---
	15-60	Marl------------	---	---	0	---	---	---	---	---	---
77------------- Napoleon	0-4	Muck------------	PT	A-8	0	---	---	---	---	---	---
	4-60	Mucky-peat-------	PT	A-8	0	---	---	---	---	---	---
83*:											
Histosols-------	0-51	Muck------------	PT	A-8	0	---	---	---	---	---	NP
	51-60	Variable---------	---	---	---	---	---	---	---	---	---
Aquents---------	0-60	Variable---------	---	---	---	---	---	---	---	---	---
84F*: Dune land.											
Quartzipsamments	0-80	Sand------------	SM, SP-SM	A-2-4, A-3	0	100	100	50-70	5-15	---	NP
Psammaquents----	0-60	Fine sand--------	SP, SP-SM, SM	A-1, A-2, A-3	0-5	85-100	80-100	40-80	2-35	<20	NP
85F*:											
Udorthents------	0-80	Variable---------	---	---	---	---	---	---	---	---	---
Quartzipsamments	0-80	Sand------------	SM, SP-SM	A-2-4, A-3	0	100	100	50-70	5-15	---	NP
86F*: Dune land.											
Quartzipsamments	0-80	Sand------------	SM, SP-SM	A-2-4, A-3	0	100	100	50-70	5-15	---	NP
87. Beaches											
88A------------ Udipsamments	0-60	Sand------------	SP, SP-SM, SM	A-1, A-2, A-3	0	85-100	75-100	30-75	0-25	---	NP
89A------------ Udorthents	0-80	Variable---------	---	---	---	---	---	---	---	---	---
91. Pits, sand and gravel											
92B, 92C--------- Chelsea	0-9	Fine sand--------	SP, SP-SM, SM	A-3, A-2-4	0	100	100	65-95	3-15	---	NP
	9-60	Fine sand, loamy sand, loamy fine sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
96B*, 96C*, 96D*, 96E*:											
Spinks	0-9	Loamy fine sand	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	9-24	Sand, fine sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	24-60	Fine sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
Tekenink	0-9	Loamy fine sand	SM, SC-SM	A-2-4, A-4, A-1-b	0-10	95-100	80-100	45-95	15-40	<25	NP-6
	9-15	Loamy fine sand, loamy sand.	SM, SC-SM, SC	A-4, A-2-4	0-10	95-100	80-100	50-85	15-50	<25	NP-10
	15-35	Loamy fine sand, fine sandy loam, sandy loam.	SM, SC, CL, ML	A-4, A-2-4, A-1-b	0-10	95-100	80-100	35-95	10-75	<25	NP-10
	35-46	Sandy loam, fine sandy loam, loam.	SC-SM, SC, CL, CL-ML	A-4, A-2-4, A-2-6	0-10	95-100	80-100	45-95	20-75	<30	4-15
	46-60	Sandy loam, fine sandy loam, loamy sand.	SM, SC, SC-SM, SP-SM	A-4, A-2-4, A-1-b	0-10	95-100	80-100	35-85	10-50	<25	NP-10
97*:											
Kerston	0-13	Muck	PT	A-8	0	---	---	---	---	---	---
	13-26	Muck	PT	A-8	0	---	---	---	---	---	---
	26-33	Sand, loamy sand	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-80	5-30	---	NP-7
	33-46	Muck	PT	A-8	0	---	---	---	---	---	---
	46-60	Sand, loamy sand	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	45-75	5-30	---	NP-7
Carlisle	0-60	Muck	PT	A-8	0-30	---	---	---	---	---	---
98B*, 98C*, 98D*:											
Spinks	0-9	Loamy fine sand	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	9-24	Sand, fine sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	24-60	Fine sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
Scalley	0-6	Fine sandy loam	SC-SM, SC	A-2, A-4	0-5	95-100	85-100	50-85	25-50	20-30	4-10
	6-22	Fine sandy loam, clay loam, silty clay loam.	SC-SM, SC, CL, CL-ML	A-2, A-4, A-6, A-7	0-5	95-100	85-100	50-95	25-85	20-45	4-20
	22-34	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	85-100	70-95	50-85	30-45	10-20
	34-60	Sand, loamy sand	SM, SP-SM	A-2-4, A-1-b, A-3	0-5	95-100	85-100	45-80	5-30	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
99B*:											
Nappanee--------	0-9	Silt loam--------	CL	A-6	0-5	95-100	90-100	85-100	55-90	30-40	10-15
	9-19	Silty clay, clay	CH	A-7	0-5	95-100	90-100	85-100	70-95	50-70	25-45
	19-60	Silty clay, clay	CH	A-7	0-5	95-100	90-100	85-100	70-95	40-60	20-35
Hoytville-------	0-9	Silt loam--------	CL	A-6	0-5	100	90-100	85-100	75-90	30-40	15-25
	9-44	Clay, silty clay	CH, CL, MH	A-7	0-5	100	85-100	80-100	75-100	42-66	22-40
	44-60	Clay, silty clay	CH	A-7	0-5	100	85-100	80-100	75-100	40-62	22-40
100B------------- Nappanee	0-9	Silt loam--------	CL	A-6	0-5	95-100	90-100	85-100	55-90	30-40	10-15
	9-19	Silty clay, clay	CH	A-7	0-5	95-100	90-100	85-100	70-95	50-70	25-45
	19-60	Silty clay, clay	CH	A-7	0-5	95-100	90-100	85-100	70-95	40-60	20-35
101B, 101C------- Claybanks	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	95-100	85-100	75-100	55-90	20-40	5-15
	7-11	Silt loam, silty clay.	CL, CL-ML, CH	A-4, A-6, A-7-6	0	95-100	85-100	75-100	60-100	20-55	4-30
	11-17	Clay, silty clay	CH	A-7	0	95-100	85-100	80-100	75-90	55-65	30-40
	17-60	Clay, silty clay	CH	A-7	0	95-100	85-100	80-100	75-90	55-65	30-40
210B*, 210C*, 210D*----------- Typic Udipsamments	0-3	Sand-------------	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	3-36	Sand-------------	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	36-99	Sand, coarse sand, fine sand.	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	0-15	---	NP
211B*, 211C*----- Typic Udipsamments	0-2	Sand-------------	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	2-40	Sand-------------	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	40-60	Sand, coarse sand, fine sand.	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	60-99	Stratified sand to sandy loam.	SM, SC-SM, SC, SP-SM	A-3, A-1, A-2, A-4	0	90-100	85-100	40-70	5-40	<30	NP-10
212B*------------ Typic Udipsamments	0-2	Sand-------------	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	2-40	Sand-------------	SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	40-99	Sand, coarse sand	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	0-15	---	NP
213B*, 213C*, 213D*----------- Argic Udipsamments	0-3	Sand-------------	SP-SM, SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	3-31	Sand, coarse sand	SP, SP-SM, SM	A-3, A-1, A-2	0	90-100	85-100	40-70	0-15	---	NP
	31-99	Stratified sand to sandy loam.	SP-SM, SM	A-3, A-2	0	90-100	85-100	50-75	5-30	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
220B*, 220C*, 220D*, 220E*---- Entic Haplorthods, sandy	0-3	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	3-48	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	48-99	Sand, coarse sand, gravelly sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	35-70	0-15	---	NP
221B*, 221C*, 221D*, 221E*---- Entic Haplorthods, sandy	0-3	Sand-------------	SP, SP-SM SM	A-2, A-3, A-1	0	95-100	85-100	40-70	1-15	---	NP
	3-35	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	45-70	1-15	---	NP
	35-60	Sand, coarse sand, gravelly sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	45-70	1-15	---	NP
	60-90	Stratified sand to sandy loam.	SP, SM, SC-SM, SC	A-3, A-1, A-2, A-4	0	95-100	85-100	40-70	1-40	0-30	NP-10
222B*, 222C*----- Entic Haplorthods, sandy	0-3	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	3-35	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	35-99	Sand, coarse sand, gravelly sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	0-15	---	NP
223B*, 223C*, 223D*, 223E*---- Entic Haplorthods, sandy	0-3	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	3-35	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	35-60	Sand, coarse sand, gravelly sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	0-15	---	NP
	60-99	Stratified sand to sandy clay loam.	SM, SC, CL, SP-SM	A-3, A-2, A-4, A-6	0	95-100	85-100	40-90	5-55	0-40	NP-20
224B*------------ Entic Haplorthods, sandy	0-3	Sand-------------	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	40-70	3-15	---	NP
	3-35	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	40-70	3-15	---	NP
	35-99	Sand, coarse sand, gravelly sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	40-70	0-15	---	NP
225B*, 225C*, 225D*----------- Entic Haplorthods, sandy	0-3	Sand-------------	SP-SM, SM	A-2, A-1, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-35	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	95-100	90-100	45-70	3-15	---	NP
	35-60	Sand, coarse sand, gravelly sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	95-100	90-100	45-70	0-15	---	NP
	60-99	Sandy clay loam, clay loam.	SC, CL	A-6, A-7, A-2-6	0	95-100	85-100	65-95	30-80	30-50	10-25

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
230B*, 230C*, 230D*, 230E*----Entic Haplorthods, sandy	0-3	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	45-70	1-15	---	NP
	3-33	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	45-70	1-15	---	NP
	33-60	Sand, coarse sand, gravelly sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	45-70	1-15	---	NP
	60-99	Stratified sand to sandy loam.	SP, SM, SC, SC-SM	A-1, A-2, A-3, A-4	0	95-100	85-100	40-70	1-40	0-30	NP-10
231B*:											
Entic Haplorthods, sandy----------	0-3	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	3-48	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-25	---	NP
	48-99	Sand, coarse sand, gravelly sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	35-70	0-15	---	NP
Alfic Haplorthods, sandy over loamy----------	0-3	Sand-------------	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
	3-22	Sand, fine sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-95	5-35	---	NP
	22-34	Sandy clay loam, clay loam, silty clay loam.	SC, CL	A-2, A-6, A-7	0	95-100	90-100	70-100	30-95	30-50	11-25
	34-99	Stratified sand to sandy clay loam.	SM, SC, CL, SC-SM	A-2, A-3, A-4, A-6	0	95-100	90-100	45-90	5-55	0-40	NP-20
233B*, 233C*, 233D*, 233E*:											
Alfic Haplorthods, sandy over loamy---------	0-3	Sand-------------	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
	3-22	Sand, fine sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-95	5-35	---	NP
	22-34	Sandy clay loam, clay loam, silty clay loam.	SC, CL	A-2, A-6, A-7	0	95-100	90-100	70-100	30-95	30-50	11-25
	34-99	Stratified sand to sandy clay loam.	SM, SC, CL, SC-SM	A-2, A-3, A-4, A-6	0	95-100	90-100	45-90	5-55	0-40	NP-20
Entic Haplorthods, sandy---------	0-3	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-15	---	NP
	3-48	Sand, laomy sand, fine sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	3-25	---	NP
	48-99	Sand, coarse sand, gravelly sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	35-70	0-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
235B*, 235C*:											
Alfic Haplorthods, sandy over loamy	0-3	Sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
	3-22	Sand, fine sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-95	5-35	---	NP
	22-34	Sandy clay loam, clay loam, silty clay loam.	SC, CL	A-2, A-6, A-7	0	95-100	90-100	70-100	30-95	30-50	11-25
	34-99	Stratified sand to sandy clay loam.	SM, SC, CL, SC-SM	A-2, A-3, A-4, A-6	0	95-100	90-100	45-90	5-55	0-40	NP-20
Alfic Haplorthods, sandy	0-4	Sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
	4-42	Sand, loamy sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-75	5-30	---	NP
	42-52	Sandy loam, clay loam, silty clay loam.	SC, CL	A-2-6, A-2-7, A-6, A-7	0	95-100	90-100	70-100	30-95	30-50	11-25
	52-99	Sand, loamy fine sand, sandy loam.	SP-SM, SM, SC, SC-SM	A-1, A-2, A-3, A-4	0	95-100	90-100	40-70	5-40	<30	NP-9
240C*: Entic Haplorthods, sandy	0-2	Sand	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	5-15	---	NP
	2-36	Sand	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	5-15	---	NP
	36-99	Sand, coarse sand	SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	5-15	---	NP
241B*: Entic Haplorthods, sandy	0-3	Sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	3-47	Sand, loamy sand, fine sand.	SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	47-60	Sand, coarse sand, gravelly sand.	SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	45-70	5-15	---	NP
	60-99	Stratified sand to sandy loam.	SM, SC, SP-SM, SC-SM	A-1-b, A-2-4, A-3	0	95-100	90-100	40-70	5-40	0-30	NP-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
245B*, 245C*, 245D*: Entic Haplorthods, sandy	0-2	Sand	SP-SM, SM	A-2-4, A-1-b, A-3	0	95-100	90-100	45-70	5-15	---	NP
	2-40	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	95-100	90-100	45-70	3-15	---	NP
	40-45	Sand, coarse sand, gravelly sand.	SP, SP-SM, SM	A-2-4, A-1-b, A-3	0	95-100	90-100	45-70	0-15	---	NP
	45-60	Sandy clay loam, clay loam.	SC, CL	A-6, A-7, A-2-6	0	95-100	85-100	65-95	30-80	30-50	10-25
250*: Mollic Psammaquents	0-3	Muck	---	---	---	---	---	---	---	---	---
	3-8	Fine sandy loam, sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	95-100	85-100	50-85	30-50	<25	NP-10
	8-20	Loamy sand, sand, fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	40-90	2-30	---	NP
	20-60	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	40-90	2-30	---	NP
Aquic Udipsamments	0-3	Sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
	3-7	Sand, loamy sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-25	---	NP
	7-41	Sand, loamy sand, fine sand.	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
	41-60	Sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
Medisaprists, euic	0-51	Muck	PT	A-8	---	---	---	---	---	---	---
	51-60	Variable	---	---	---	---	---	---	---	---	---
262A*: Aeric Haplaquods, sandy, ortstein	0-5	Sand	SP-SM, SM	A-3, A-1, A-2	0	95-100	90-100	45-70	5-15	---	NP
	5-11	Sand, loamy sand, fine sand.	SP-SM, SM	A-3, A-1, A-2	0	95-100	90-100	45-70	5-15	---	NP
	11-17	Sand, coarse sand, loamy sand.	SP-SM, SM	A-3, A-1, A-2	0	95-100	90-100	45-70	5-15	---	NP
	17-60	Sand, coarse sand, loamy sand.	SP-SM, SM	A-3, A-1, A-2	0	95-100	90-100	45-70	5-15	---	NP
263A*: Aquic Udipsamments	0-3	Sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
	3-7	Sand, loamy sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-75	5-25	---	NP
	7-41	Sand, loamy sand, fine sand.	SM, SM, SP-SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
	41-60	Sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
272* Typic Haplaquods, sandy	0-6	Sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
	6-25	Sand	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
	25-60	Sand, loamy fine sand, coarse sand.	SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	5-15	---	NP
273* Mollic Psammaquents	0-3	Muck	---	---	---	---	---	---	---	---	---
	3-8	Fine sandy loam, sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	95-100	85-100	55-85	30-50	<25	NP-10
	8-20	Loamy sand, sand, fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	40-90	2-30	---	NP
	20-60	Sand, loamy sand, fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	85-100	40-90	2-30	---	NP
274* Typic Haplaquolls, sandy over loamy	0-2	Muck	PT	A-8	0	---	---	---	---	---	---
	2-10	Loamy fine sand	SM	A-4	0	95-100	90-100	80-95	40-50	---	NP
	10-20	Fine sand, sand, loamy fine sand.	SM, SP-SM	A-3, A-4, A-2, A-1	0	95-100	90-100	45-95	5-50	---	NP
	20-60	Sandy clay loam, silt loam, silty clay loam.	SC-SM, SC, CL-ML, CL	A-2-6, A-6, A-7	0	95-100	90-100	70-100	30-95	20-50	6-25
280*:											
Aquents	0-60	Variable	---	---	---	---	---	---	---	---	---
Histosols	0-51	Muck	PT	A-8	0	---	---	---	---	---	NP
	51-60	Variable	---	---	---	---	---	---	---	---	---
281 Medisaprists, dysic	0-51	Muck	---	---	---	---	---	---	---	---	---
	51-60	Variable	---	---	---	---	---	---	---	---	---
282 Medisaprists, euic	0-51	Muck	PT	A-8	---	---	---	---	---	---	---
	51-60	Variable	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
10B, 10C, 10D, 10E	0-9	10-27	1.35-1.55	0.6-2.0	0.17-0.24	5.6-7.8	Low	0.37	5	5	1-3
Perrinton	9-18	10-50	1.35-1.65	0.2-0.6	0.11-0.20	5.6-7.8	Moderate	0.32			
	18-35	35-50	1.50-1.70	0.06-0.2	0.10-0.20	5.6-8.4	Moderate	0.32			
	35-60	30-50	1.65-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate	0.32			
11A	0-9	8-27	1.40-1.70	0.6-2.0	0.18-0.22	5.1-7.3	Low	0.32	5	5	1-4
Ithaca	9-13	12-40	1.40-1.60	0.2-0.6	0.14-0.18	5.1-7.3	Low	0.28			
	13-24	35-50	1.40-1.65	0.06-0.2	0.10-0.20	5.1-7.8	Moderate	0.32			
	24-60	30-50	1.50-1.65	0.06-0.2	0.13-0.20	7.3-8.4	Moderate	0.32			
12	0-11	15-27	1.30-1.55	0.6-2.0	0.22-0.24	6.1-7.8	High	0.28	5	4	4-8
Bono	11-32	40-55	1.35-1.55	0.06-0.2	0.10-0.14	6.1-8.4	High	0.28			
	32-60	35-60	1.45-1.60	<0.2	0.08-0.12	7.4-8.4	High	0.28			
13B, 13C, 13D	0-8	10-18	1.50-1.65	2.0-6.0	0.11-0.18	5.6-7.3	Low	0.24	5	3	1-3
Marlette	8-12	10-35	1.50-1.65	0.2-2.0	0.11-0.20	5.6-7.3	Low	0.28			
	12-25	27-35	1.50-1.70	0.2-0.6	0.18-0.20	5.6-7.8	Low	0.32			
	25-60	25-30	1.50-1.75	0.2-0.6	0.12-0.19	6.6-8.4	Low	0.32			
14B	0-9	5-15	1.40-1.70	2.0-6.0	0.13-0.16	5.6-7.3	Low	0.24	5	3	2-6
Capac	9-36	18-35	1.45-1.70	0.2-0.6	0.14-0.18	5.6-7.3	Low	0.32			
	36-60	10-35	1.50-1.70	0.2-0.6	0.14-0.17	7.4-8.4	Low	0.32			
16B, 16C, 16D	0-9	8-18	1.10-1.60	2.0-6.0	0.10-0.18	5.1-7.3	Low	0.24	3	3	1-2
Remus	9-21	5-18	1.30-1.75	2.0-6.0	0.08-0.17	5.1-7.3	Low	0.24			
	21-50	10-30	1.65-1.80	0.2-0.6	0.08-0.16	5.1-7.3	Low	0.28			
	50-60	15-30	1.30-1.80	0.2-0.6	0.08-0.16	5.1-8.4	Low	0.28			
17B*, 17C*, 17D*:											
Marlette	0-8	10-18	1.50-1.65	2.0-6.0	0.11-0.18	5.6-7.3	Low	0.24	5	3	1-3
	8-12	10-35	1.50-1.65	0.2-2.0	0.11-0.20	5.6-7.3	Low	0.28			
	12-25	27-35	1.50-1.70	0.2-0.6	0.18-0.20	5.6-7.8	Low	0.32			
	25-60	25-30	1.50-1.75	0.2-0.6	0.12-0.19	6.6-8.4	Low	0.32			
Fern	0-10	5-10	1.30-1.55	6.0-20	0.10-0.12	5.6-7.3	Low	0.17	5	2	1-3
	10-21	1-12	1.30-1.60	6.0-20	0.06-0.11	5.6-7.3	Low	0.17			
	21-51	5-27	1.40-1.70	0.6-6.0	0.08-0.18	5.6-7.3	Low	0.37			
	51-60	18-30	1.50-1.70	0.6-2.0	0.15-0.18	6.1-7.3	Low	0.37			
18B*, 18C*, 18D*:											
Spinks	0-9	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low	0.17	5	2	2-4
	9-24	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low	0.17			
	24-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low	0.17			
Gowdy	0-9	4-10	1.55-1.70	6.0-20	0.09-0.13	5.1-7.3	Low	0.17	5	2	.5-2
	9-28	2-10	1.55-1.70	6.0-20	0.07-0.09	5.1-7.3	Low	0.17			
	28-32	35-60	1.35-1.70	0.06-0.2	0.11-0.20	5.1-7.3	High	0.43			
	32-42	35-60	1.45-1.55	0.06-0.2	0.09-0.20	5.1-7.3	High	0.43			
	42-60	35-60	1.30-1.65	0.06-0.2	0.18-0.20	7.4-8.4	HIgh	0.43			
20B*, 20C*, 20D*:											
Arkport	0-8	5-15	1.10-1.40	2.0-6.0	0.08-0.09	4.5-7.3	Low	0.17	3	---	.5-2
	8-22	3-15	1.25-1.55	2.0-6.0	0.06-0.16	4.5-7.3	Low	0.28			
	22-60	1-5	1.25-1.55	2.0-6.0	0.06-0.12	5.1-7.3	Low	0.28			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
20B*, 20C*, 20D*:											
Chelsea	0-9	3-8	1.50-1.55	6.0-20	0.06-0.08	5.6-7.3	Low	0.15	5	1	.5-1
	9-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-6.5	Low	0.17			
21A	0-9	5-15	1.35-1.55	0.6-2.0	0.11-0.13	6.1-8.4	Low	0.24	5	2	2-4
Freesoil	9-24	5-20	1.35-1.60	0.6-2.0	0.08-0.22	7.3-8.4	Low	0.24			
	24-60	5-30	1.50-1.65	0.6-6.0	0.07-0.20	7.9-8.4	Low	0.24			
22B, 22C	0-9	4-10	1.55-1.70	6.0-20	0.09-0.13	5.1-7.3	Low	0.17	5	2	.5-2
Gowdy	9-28	2-10	1.55-1.70	6.0-20	0.07-0.09	5.1-7.3	Low	0.17			
	28-32	35-60	1.35-1.70	0.06-0.2	0.11-0.20	5.1-7.3	High	0.43			
	32-42	35-60	1.45-1.55	0.06-0.2	0.09-0.20	5.1-7.3	High	0.43			
	42-60	35-60	1.30-1.65	0.06-0.2	0.18-0.20	7.4-8.4	High	0.43			
23A	0-7	1-12	1.25-1.40	2.0-20	0.10-0.12	5.1-7.3	Low	0.17	4	2	1-3
Arkona	7-31	3-15	1.35-1.45	6.0-20	0.06-0.11	5.1-7.3	Low	0.17			
	31-60	35-50	1.50-1.75	<0.06	0.08-0.12	5.6-8.4	Moderate	0.28			
24	0-9	2-12	1.35-1.50	2.0-6.0	0.10-0.12	5.6-7.3	Low	0.17	4	2	4-6
Sickles	9-32	2-12	1.40-1.55	6.0-20	0.06-0.11	6.1-7.3	Low	0.17			
	32-60	35-50	1.50-1.75	<0.06	0.08-0.12	7.9-8.4	High	0.32			
25B*, 25C*, 25D*, 25E*:											
Gowdy	0-9	4-10	1.55-1.70	6.0-20	0.09-0.13	5.1-7.3	Low	0.17	5	2	.5-2
	9-28	2-10	1.55-1.70	6.0-20	0.07-0.09	5.1-7.3	Low	0.17			
	28-32	35-60	1.35-1.70	0.06-0.2	0.11-0.20	5.1-7.3	High	0.43			
	32-42	35-60	1.45-1.55	0.06-0.2	0.09-0.20	5.1-7.3	High	0.43			
	42-60	35-60	1.30-1.65	0.06-0.2	0.18-0.20	7.4-8.4	High	0.43			
Perrinton	0-9	10-27	1.35-1.55	0.6-2.0	0.17-0.24	5.6-7.8	Low	0.37	3	5	1-3
	9-18	10-50	1.35-1.65	0.2-0.6	0.11-0.20	5.6-7.8	Moderate	0.32			
	18-35	35-50	1.50-1.70	0.06-0.2	0.10-0.20	5.6-8.4	Moderate	0.32			
	35-60	30-50	1.65-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate	0.32			
26A*:											
Arkona	0-7	1-12	1.25-1.40	2.0-20	0.10-0.12	5.1-7.3	Low	0.17	4	2	1-3
	7-31	3-15	1.35-1.45	6.0-20	0.06-0.11	5.1-7.3	Low	0.17			
	31-60	35-50	1.50-1.75	<0.06	0.08-0.12	5.6-8.4	Moderate	0.28			
Ithaca	0-9	8-27	1.40-1.70	0.6-2.0	0.18-0.22	5.1-7.3	Low	0.32	3	5	1-4
	9-13	12-40	1.40-1.60	0.2-0.6	0.14-0.18	5.1-7.3	Low	0.28			
	13-24	35-50	1.40-1.65	0.06-0.2	0.10-0.20	5.1-7.8	Moderate	0.32			
	24-60	30-50	1.50-1.65	0.06-0.2	0.13-0.20	7.3-8.4	Moderate	0.32			
27B*:											
Arkona	0-7	1-12	1.25-1.40	2.0-20	0.10-0.12	5.1-7.3	Low	0.17	4	2	1-3
	7-31	3-15	1.35-1.45	6.0-20	0.06-0.11	5.1-7.3	Low	0.17			
	31-60	35-50	1.50-1.75	<0.06	0.08-0.12	5.6-8.4	Moderate	0.28			
Del Rey	0-8	15-27	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.8	Low	0.43	3	6	2-3
	8-32	35-45	1.40-1.65	0.06-0.2	0.12-0.20	4.5-8.4	Moderate	0.43			
	32-60	25-35	1.50-1.70	0.06-0.2	0.09-0.11	7.9-8.4	Moderate	0.43			
28B, 28C, 28D	0-10	5-10	1.30-1.55	6.0-20	0.10-0.12	5.6-7.3	Low	0.17	5	2	1-3
Fern	10-21	1-12	1.30-1.60	6.0-20	0.06-0.11	5.6-7.3	Low	0.17			
	21-51	5-27	1.40-1.70	0.6-6.0	0.08-0.18	5.6-7.3	Low	0.37			
	51-60	18-30	1.50-1.70	0.6-2.0	0.15-0.18	6.1-7.3	Low	0.37			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
29A--------------- Dixboro	0-9	2-12	1.30-1.65	2.0-6.0	0.10-0.14	5.6-7.3	Low-----------	0.20	5	2	2-3
	9-24	6-17	1.40-1.70	0.6-2.0	0.15-0.20	5.6-7.8	Low-----------	0.32			
	24-60	0-15	1.50-1.65	0.6-2.0	0.07-0.20	6.6-8.4	Low-----------	0.24			
30---------------- Lamson	0-7	---	0.13-0.23	0.6-6.0	0.35-0.45	5.6-7.3	--------------	----	3	2	25-75
	7-80	1-10	1.45-1.65	0.6-6.0	0.02-0.04	6.1-8.4	Low-----------	0.20			
35B*, 35C*, 35D*: Alvin------------	0-8	10-15	1.45-1.65	2.0-6.0	0.14-0.17	4.5-7.3	Low-----------	0.24	5	3	.5-1
	8-15	10-15	1.45-1.65	0.6-6.0	0.10-0.17	4.5-7.3	Low-----------	0.24			
	15-22	15-18	1.40-1.65	0.6-6.0	0.14-0.18	4.5-7.3	Low-----------	0.24			
	22-80	3-10	1.45-1.65	2.0-6.0	0.10-0.15	5.1-8.4	Low-----------	0.24			
Spinks-----------	0-9	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low-----------	0.17	5	2	2-4
	9-24	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low-----------	0.17			
	24-80	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low-----------	0.17			
36A--------------- Del Rey	0-8	15-27	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.8	Low-----------	0.43	3	6	2-3
	8-32	35-45	1.40-1.65	0.06-0.2	0.12-0.20	4.5-8.4	Moderate------	0.43			
	32-60	25-35	1.50-1.70	0.06-0.2	0.09-0.11	7.9-8.4	Moderate------	0.43			
37A--------------- Altmar	0-9	1-5	1.10-1.40	2.0-6.0	0.07-0.16	5.1-7.3	Low-----------	0.17	5	2	2-5
	9-24	1-10	1.25-1.55	6.0-20	0.04-0.08	5.1-7.8	Low-----------	0.17			
	24-60	1-3	1.45-1.65	6.0-20	0.02-0.04	7.4-8.4	Low-----------	0.10			
38B*, 38C*, 38D*, 38E*: Spinks----------	0-9	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low-----------	0.17	5	2	2-4
	9-24	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low-----------	0.17			
	24-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low-----------	0.17			
Okee------------	0-3	4-10	1.55-1.70	2.0-6.0	0.07-0.13	5.6-7.3	Low-----------	0.17	4	2	.5-2
	3-25	2-10	1.50-1.65	0.6-6.0	0.05-0.12	5.6-7.3	Low-----------	0.17			
	25-33	10-18	1.55-1.70	0.6-6.0	0.12-0.16	5.6-7.8	Low-----------	0.32			
	33-60	2-15	1.35-1.70	2.0-20	0.07-0.12	7.4-8.4	Low-----------	0.17			
40B*, 40C*, 40D*: Coloma-----------	0-4	0-10	1.35-1.65	6.0-20	0.05-0.09	4.5-7.3	Low-----------	0.15	5	1	.5-2
	4-35	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low-----------	0.15			
	35-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low-----------	0.15			
Toogood----------	0-4	2-10	1.25-1.55	6.0-20	0.06-0.09	5.1-7.3	Low-----------	0.17	4	2	.5-2
	4-36	2-10	1.40-1.65	6.0-20	0.05-0.11	5.1-7.3	Low-----------	0.17			
	36-38	10-20	1.35-1.65	6.0-20	0.09-0.12	5.6-8.4	Low-----------	0.17			
	38-60	0-10	1.50-1.65	>20	0.02-0.04	7.3-8.4	Low-----------	0.10			
41---------------- Granby	0-10	0-10	1.10-1.20	6.0-20	0.15-0.20	5.6-7.3	Low-----------	0.17	5	2	10-15
	10-28	0-14	1.45-1.60	6.0-20	0.05-0.12	5.6-7.8	Low-----------	0.15			
	28-60	0-10	1.45-1.60	6.0-20	0.05-0.12	6.6-8.4	Low-----------	0.15			
42B*, 42C*, 42D*, 42E*: Spinks----------	0-9	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low-----------	0.17	5	2	2-4
	9-24	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low-----------	0.17			
	24-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low-----------	0.17			
Remus-----------	0-9	8-18	1.10-1.60	2.0-6.0	0.10-0.18	5.1-7.3	Low-----------	0.24	3	3	1-2
	9-21	5-18	1.30-1.75	2.0-6.0	0.08-0.17	5.1-7.3	Low-----------	0.24			
	21-38	10-30	1.65-1.80	0.2-0.6	0.08-0.16	5.1-7.3	Low-----------	0.28			
	38-60	15-30	1.30-1.80	0.2-0.6	0.08-0.16	5.1-8.4	Low-----------	0.28			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
42B*, 42C*, 42D*, 42E*:											
Fern	0-10	5-10	1.30-1.55	6.0-20	0.10-0.12	5.6-7.3	Low	0.17	5	2	1-3
	10-21	1-12	1.30-1.60	6.0-20	0.06-0.11	5.6-7.3	Low	0.17			
	21-51	5-30	1.40-1.70	0.6-6.0	0.08-0.18	5.6-7.3	Low	0.37			
	51-60	18-30	1.50-1.70	0.6-2.0	0.15-0.18	6.1-7.3	Low	0.37			
43B, 43C, 43D, 43E Spinks	0-9	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low	0.17	5	2	2-4
	9-24	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low	0.17			
	24-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low	0.17			
44B Thetford	0-9	2-15	1.30-1.60	2.0-6.0	0.09-0.11	5.6-7.3	Low	0.17	5	2	1-4
	9-24	2-15	1.30-1.60	2.0-20	0.07-0.11	5.6-7.3	Low	0.17			
	24-54	8-18	1.45-1.65	2.0-6.0	0.06-0.08	5.6-7.8	Low	0.17			
	54-60	0-10	1.45-1.65	6.0-20	0.05-0.08	7.4-8.4	Low	0.15			
45B*, 45C*, 45D*, 45E*, 45F*:											
Spinks	0-9	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low	0.17	5	2	2-4
	9-24	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low	0.17			
	24-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low	0.17			
Benona	0-8	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-5.5	Low	0.15	5	1	.5-2
	8-46	0-10	1.40-1.60	6.0-20	0.06-0.10	4.5-6.0	Low	0.15			
	46-60	2-12	1.55-1.65	6.0-20	0.05-0.10	5.1-7.3	Low	0.17			
46B Grattan	0-3	0-10	1.35-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	.5-1
	3-32	0-10	1.40-1.60	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
	32-60	0-10	1.50-1.65	6.0-20	0.02-0.04	5.6-7.3	Low	0.15			
48A*:											
Saugatuck	0-3	2-12	1.20-1.50	6.0-20	0.07-0.09	3.6-5.5	Low	0.15	2	1	2-10
	3-7	2-12	1.30-1.55	6.0-20	0.06-0.08	3.6-5.5	Low	0.15			
	7-29	2-12	1.75-2.00	0.6-2.0	0.06-0.08	3.6-6.0	Low	0.15			
	29-60	2-12	1.50-1.65	6.0-20	0.04-0.06	5.1-6.5	Low	0.15			
Jebavy	0-4	0-10	1.20-1.50	6.0-20	0.07-0.09	3.6-5.5	Low	0.15	5	1	4-8
	4-12	0-10	1.30-1.55	6.0-20	0.06-0.08	3.6-5.5	Low	0.15			
	12-16	0-10	1.75-2.00	0.6-2.0	0.02-0.06	3.6-5.5	Low	0.15			
	16-36	0-10	1.45-1.70	6.0-20	0.02-0.04	4.5-5.5	Low	0.15			
	36-60	0-10	1.50-1.70	6.0-20	0.02-0.04	4.5-6.5	Low	0.15			
49B Grattan	0-3	0-10	1.35-1.55	6.0-20	0.06-0.08	4.5-6.5	Low	0.15	5	1	1-3
	3-32	0-10	1.40-1.60	6.0-20	0.05-0.10	4.5-6.5	Low	0.15			
	32-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
49B3 Grattan	0-22	0-10	1.40-1.60	6.0-20	0.05-0.10	4.5-6.5	Low	0.15	---	---	---
	22-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
49C Grattan	0-3	0-10	1.35-1.55	6.0-20	0.06-0.08	4.5-6.5	Low	0.15	5	1	1-3
	3-32	0-10	1.40-1.60	6.0-20	0.05-0.10	4.5-6.5	Low	0.15			
	32-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
49C3 Grattan	0-22	0-10	1.40-1.60	6.0-20	0.05-0.10	4.5-6.5	Low	0.15	---	---	---
	22-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
49E, 49F Grattan	0-3	0-10	1.35-1.55	6.0-20	0.06-0.08	4.5-6.5	Low	0.15	5	1	1-3
	3-32	0-10	1.40-1.60	6.0-20	0.05-0.10	4.5-6.5	Low	0.15			
	32-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
50B Covert	0-1	2-10	1.30-1.55	6.0-20	0.06-0.09	4.5-7.3	Low	0.15	5	1	1-2
	1-33	2-10	1.45-1.65	6.0-20	0.05-0.08	4.5-7.3	Low	0.15			
	33-60	0-10	1.30-1.60	6.0-20	0.04-0.08	4.5-7.3	Low	0.15			
51B Pipestone	0-2	2-12	1.30-1.50	6.0-20	0.07-0.10	3.6-7.3	Low	0.15	5	1	3-4
	2-38	2-12	1.40-1.70	6.0-20	0.06-0.09	3.6-7.3	Low	0.15			
	38-60	2-12	1.40-1.70	6.0-20	0.05-0.07	3.6-7.3	Low	0.15			
52 Granby	0-11	2-10	1.20-1.60	6.0-20	0.07-0.10	5.6-7.3	Low	0.15	5	1	4-10
	11-28	0-14	1.45-1.60	6.0-20	0.05-0.12	5.6-7.8	Low	0.17			
	28-60	0-10	1.45-1.60	6.0-20	0.05-0.09	6.6-8.4	Low	0.17			
53B, 53C Grattan	0-9	0-10	1.35-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-3
	9-36	0-10	1.40-1.60	6.0-20	0.04-0.10	4.5-6.5	Low	0.15			
	36-48	0-10	1.50-1.65	6.0-20	0.02-0.04	5.6-7.3	Low	0.15			
	48-60	28-35	1.45-1.70	0.06-0.6	0.14-0.16	6.6-7.8	Low	0.32			
56B, 56C, 56E Benona	0-8	0-10	1.30-1.55	6.0-20	0.07-0.09	6.1-6.5	Low	0.15	5	1	2-3
	8-48	0-10	1.30-1.55	6.0-20	0.05-0.07	6.1-6.5	Low	0.15			
	48-87	0-15	1.55-1.65	6.0-20	0.05-0.10	6.6-7.3	Low	0.15			
	87-91	27-40	1.35-1.60	0.6-2.0	0.17-0.19	6.6-7.3	Moderate	0.24			
	91-99	0-10	1.35-1.55	6.0-20	0.05-0.07	6.6-7.3	Low	0.15			
57C, 57F Nordhouse	0-1	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-2
	1-34	0-5	1.40-1.65	6.0-20	0.06-0.08	4.5-6.5	Low	0.15			
	34-60	0-5	1.40-1.65	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
58 Kingsville	0-7	2-10	0.60-1.00	6.0-20	0.16-0.18	4.5-6.0	Low	0.15	5	1	15-25
	7-24	2-10	1.20-1.50	6.0-20	0.07-0.12	4.5-7.3	Low	0.17			
	24-60	2-10	1.45-1.65	6.0-20	0.05-0.10	5.6-7.3	Low	0.17			
59B, 59C, 59E Benona	0-8	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-5.5	Low	0.15	5	1	.5-2
	8-46	0-10	1.40-1.60	6.0-20	0.06-0.10	4.5-6.0	Low	0.15			
	46-60	2-12	1.55-1.65	6.0-20	0.05-0.10	5.1-7.3	Low	0.17			
60B, 60C, 60E Coloma	0-4	0-10	1.35-1.65	6.0-20	0.05-0.09	4.5-7.3	Low	0.15	5	1	.5-2
	4-35	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low	0.15			
	35-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low	0.15			
61B, 61C, 61E Epworth	0-1	0-10	1.35-1.65	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	5	1	1-2
	1-24	0-10	1.30-1.70	6.0-20	0.06-0.08	4.5-6.0	Low	0.15			
	24-60	0-10	1.55-1.75	6.0-20	0.05-0.07	5.6-6.5	Low	0.15			
62B, 62C Plainfield	0-3	2-5	1.50-1.65	6.0-20	0.04-0.09	5.1-7.3	Low	0.15	5	1	5-2
	3-30	1-7	1.50-1.65	6.0-20	0.04-0.07	4.5-6.5	Low	0.15			
	30-60	0-4	1.50-1.70	6.0-20	0.03-0.07	4.5-6.5	Low	0.15			
65 Sloan	0-14	15-27	1.20-1.40	0.6-2.0	0.19-0.24	6.1-7.8	Low	0.28	5	6	3-6
	14-32	22-35	1.25-1.55	0.2-2.0	0.15-0.19	6.1-8.4	Moderate	0.37			
	32-60	10-30	1.20-1.50	0.2-2.0	0.13-0.18	6.6-8.4	Low	0.37			
67 Cohoctah	0-15	5-20	1.20-1.50	2.0-6.0	0.13-0.22	6.1-8.4	Low	0.24	5	3	3-15
	15-30	5-18	1.45-1.65	2.0-6.0	0.12-0.20	6.1-8.4	Low	0.28			
	30-60	2-18	1.45-1.65	2.0-6.0	0.08-0.20	6.1-8.4	Low	0.28			
69 Algansee	0-8	0-15	1.35-1.50	6.0-20	0.10-0.12	4.5-7.8	Low	0.17	5	2	2-4
	8-60	0-15	1.40-1.65	6.0-20	0.05-0.10	4.5-8.4	Low	0.17			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
70--------------- Glendora	0-8 8-60	5-15 0-10	1.00-1.35 1.40-1.65	6.0-20 6.0-20	0.14-0.16 0.05-0.11	5.6-7.8 5.6-7.8	Low---------- Low----------	0.17 0.17	5	2	10-15
71*:											
Houghton--------	0-8 8-60	--- ---	0.15-0.30 0.15-0.25	0.6-6.0 0.2-6.0	0.45-0.55 0.35-0.45	4.5-7.8 4.5-7.8	------------- -------------	---- ----	5	5	>70
Carlisle--------	0-60	---	0.13-0.23	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	5	2	>70
72--------------- Adrian	0-34 34-60	--- 2-10	0.30-0.55 1.40-1.75	0.2-6.0 6.0-20	0.35-0.45 0.03-0.08	5.1-7.3 5.6-8.4	------------- Low----------	---- 0.15	4	2	55-75
73--------------- Palms	0-10 10-18 18-60	--- --- 7-35	0.30-0.40 0.15-0.30 1.45-1.75	0.2-6.0 0.2-6.0 0.2-2.0	0.35-0.45 0.35-0.45 0.14-0.22	5.1-7.8 5.1-7.8 6.1-8.4	------------- ------------- Low----------	---- ---- 0.37	5	2	>75
75--------------- Martisco	0-15 15-60	--- ---	0.25-0.45 ---	0.6-6.0 0.06-0.2	0.35-0.45 ---	6.1-8.4 7.9-8.4	------------- Low----------	---- ----	---	2	25-75
77--------------- Napoleon	0-4 4-60	--- ---	0.30-0.40 0.10-0.20	0.2-6.0 0.6-6.0	0.35-0.45 0.45-0.55	<4.5 <4.5	------------- -------------	---- ----	5	2	70-90
83*:											
Histosols-------	0-51 51-60	--- ---	--- ---	0.2-6.0 ---	--- ---	--- ---	------------- -------------	---- ----	2	8	50-70
Aquents---------	0-60	---	---	---	---	---	-------------	----	---	---	---
84F*: Dune land.											
Quartzipsamments	0-80	0-5	1.50-1.70	6.0-20	0.03-0.06	5.1-6.5	Low----------	0.15	5	1	0-.1
Psammaquents----	0-60	0-10	1.50-1.70	>6.0	0.05-0.07	5.1-7.3	Low----------	0.15	5	1	---
85F*: Udorthents------	0-80	---	---	---	---	---	-------------	----	---	---	---
Quartzipsamments	0-80	0-5	1.50-1.70	6.0-20	0.03-0.06	5.1-6.5	Low----------	0.15	5	1	0-.1
86F*: Dune land.											
Quartzipsamments	0-80	0-5	1.50-1.70	6.0-20	0.03-0.06	5.1-6.5	Low----------	0.15	5	1	0-.1
87. Beaches											
88A-------------- Udipsamments	0-60	0-10	1.35-1.65	>60	0.05-0.09	5.1-6.5	Low----------	0.15	5	1	<1
89A-------------- Udorthents	0-80	---	---	---	---	---	-------------	----	---	---	---
91. Pits, sand and gravel											
92B, 92C--------- Chelsea	0-9 9-60	3-8 5-10	1.50-1.55 1.55-1.70	6.0-20 6.0-20	0.06-0.08 0.06-0.08	5.6-7.3 5.1-7.3	Low---------- Low----------	0.15 0.17	5	1	.5-1

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
96B*, 96C*, 96D*, 96E*:											
Spinks----------	0-9	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low-----------	0.17	5	2	2-4
	9-24	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low-----------	0.17			
	24-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low-----------	0.17			
Tekenink--------	0-9	2-12	1.30-1.60	2.0-6.0	0.08-0.12	5.1-7.3	Low-----------	0.17	5	2	1-3
	9-15	2-15	1.45-1.60	0.6-2.0	0.08-0.17	5.1-7.3	Low-----------	0.24			
	15-35	2-15	1.45-1.60	0.6-2.0	0.08-0.17	5.1-7.3	Low-----------	0.24			
	35-46	10-22	1.55-1.70	0.6-2.0	0.10-0.17	5.1-7.3	Low-----------	0.24			
	46-60	2-15	1.55-1.70	0.6-6.0	0.08-0.16	6.5-8.4	Low-----------	0.24			
97*:											
Kerston----------	0-13	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-8.4	--------------	----	3	2	60-85
	13-26	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-8.4	--------------	----			
	26-33	0-10	1.45-1.70	6.0-20	0.06-0.11	5.1-8.4	Low-----------	----			
	33-46	---	0.12-0.25	0.2-6.0	0.35-0.45	5.1-8.4	--------------	----			
	46-60	0-10	1.45-1.70	6.0-20	0.05-0.10	5.1-8.4	Low-----------	----			
Carlisle---------	0-60	---	0.13-0.23	0.2-6.0	0.35-0.45	4.5-7.8	--------------	----	5	2	>70
98B*, 98C*, 98D*:											
Spinks-----------	0-9	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low-----------	0.17	5	2	2-4
	9-24	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low-----------	0.17			
	24-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low-----------	0.17			
Scalley----------	0-6	10-18	1.30-1.60	2.0-6.0	0.12-0.15	5.6-7.3	Low-----------	0.24	4	3	1-3
	6-22	10-35	1.30-1.60	0.2-0.6	0.11-0.20	5.6-7.3	Low-----------	0.28			
	22-34	25-35	1.35-1.55	0.2-0.6	0.14-0.20	5.6-7.3	Low-----------	0.32			
	34-60	0-15	1.55-1.70	>6.0	0.02-0.10	5.6-7.8	Low-----------	0.15			
99B*:											
Nappanee---------	0-9	20-27	1.30-1.50	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.37	3	6	1-3
	9-19	45-60	1.40-1.65	0.06-0.2	0.08-0.14	5.1-8.4	Moderate------	0.37			
	19-60	40-50	1.50-1.75	0.06-0.2	0.06-0.12	7.4-8.4	Moderate------	0.37			
Hoytville--------	0-9	24-27	1.25-1.50	0.2-2.0	0.20-0.24	6.1-7.8	Moderate------	0.28	5	6	3-6
	9-44	40-55	1.35-1.60	0.2-0.6	0.08-0.17	6.1-7.8	High----------	0.28			
	44-60	35-50	1.40-1.80	0.06-0.2	0.06-0.10	7.4-8.4	High----------	0.28			
100B------------- Nappanee	0-9	20-27	1.30-1.50	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.37	3	6	1-3
	9-19	45-60	1.40-1.65	0.06-0.2	0.08-0.14	5.1-8.4	Moderate------	0.37			
	19-60	40-50	1.50-1.75	0.06-0.2	0.06-0.12	7.4-8.4	Moderate------	0.37			
101B, 101C------- Claybanks	0-7	12-27	1.50-1.70	2.0-6.0	0.13-0.15	6.1-7.8	Low-----------	0.37	5	6	1-3
	7-11	10-50	1.40-1.60	0.2-0.6	0.20-0.24	6.1-7.8	Moderate------	0.37			
	11-17	50-60	1.50-1.70	0.06-0.2	0.11-0.13	6.6-7.8	High----------	0.37			
	17-60	50-60	1.60-1.75	0.06-0.2	0.11-0.13	7.4-8.4	High----------	0.37			
210B*, 210C*, 210D*----------- Typic Udipsamments	0-3	0-4	1.30-1.55	6.0-20	0.06-0.08	4.5-6.5	Low-----------	0.15	5	1	1-5
	3-36	0-4	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
	36-99	0-4	1.50-1.65	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
211B*, 211C*----- Typic Udipsamments	0-2	0-4	1.30-1.55	6.0-20	0.06-0.08	4.5-6.5	Low-----------	0.15	5	1	1-5
	2-40	0-4	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
	40-60	0-4	1.50-1.65	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
	60-99	0-20	1.55-1.70	0.6-20	0.04-0.12	4.5-6.5	Low-----------	0.20			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
212B*	0-2	0-4	1.30-1.55	6.0-20	0.06-0.08	4.5-6.5	Low	0.15	5	1	1-5
Typic	2-40	0-4	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
Udipsamments	40-99	0-4	1.50-1.65	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
213B*, 213C*, 213D*	0-3	0-4	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-5
Argic	3-31	0-4	1.40-1.60	6.0-20	0.06-0.08	4.5-6.5	Low	0.15			
Udipsamments	31-99	2-12	1.50-1.65	6.0-20	0.04-0.08	4.5-6.5	Low	0.15			
220B*, 220C*, 220D*, 220E*	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	5	1	1-5
Entic	3-48	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
Haplorthods,	48-99	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
sandy											
221B*, 221C*, 221D*, 221E*	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-5
Entic	3-35	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
Haplorthods,	35-60	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
sandy	60-90	0-20	1.55-1.70	0.6-20	0.07-0.10	5.6-7.3	Low	0.17			
222B*, 222C*	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	5	1	1-5
Entic	3-35	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
Haplorthods,	35-99	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
sandy											
223B*, 223C*, 223D*, 223E*	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-5
Entic	3-35	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
Haplorthods,	35-60	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
sandy	60-99	0-35	1.50-1.70	0.2-20	0.04-0.17	5.6-7.3	Moderate	0.28			
224B*	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	5	1	1-5
Entic	3-35	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
Haplorthods,	35-99	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
sandy											
225B*, 225C*, 225D*	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-5
Entic	3-35	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
Haplorthods,	35-60	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
sandy	60-99	20-40	1.30-1.65	0.2-0.6	0.14-0.16	5.6-8.4	Moderate	0.37			
230B*, 230C*, 230D*, 230E*	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-5
Entic	3-33	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
Haplorthods,	33-60	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
sandy	60-99	0-18	1.55-1.70	0.6-20	0.04-0.10	7.9-8.4	Low	0.17			
231B*:											
Entic Haplorthods, sandy	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	5	1	1-5
	3-48	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
	48-99	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
231B*:											
Alfic Haplorthods, sandy over loamy	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	5	1	1-5
	3-22	0-10	1.40-1.65	6.0-20	0.06-0.11	5.1-7.3	Low	0.15			
	22-34	20-40	1.45-1.60	0.2-2.0	0.16-0.20	6.1-8.4	Moderate	0.37			
	34-99	5-20	1.50-1.65	0.2-20	0.04-0.17	6.1-8.4	Low	0.28			
233B*, 233C*, 233D*, 233E*:											
Alfic Haplorthods, sandy over loamy	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	5	1	1-5
	3-22	0-10	1.40-1.65	6.0-20	0.06-0.11	5.1-7.3	Low	0.15			
	22-34	20-40	1.45-1.60	0.2-2.0	0.16-0.20	6.1-8.4	Moderate	0.37			
	34-99	5-20	1.50-1.65	0.2-20	0.04-0.17	6.1-8.4	Low	0.28			
Entic Haplorthods, sandy	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	5	1	1-5
	3-48	0-5	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
	48-99	0-5	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
235B*, 235C*:											
Alfic Haplorthods, sandy over loamy	0-3	0-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	5	1	1-5
	3-22	0-10	1.40-1.65	6.0-20	0.06-0.11	5.1-7.3	Low	0.15			
	22-34	20-40	1.45-1.60	0.2-2.0	0.16-0.20	6.1-8.4	Moderate	0.37			
	34-99	5-20	1.50-1.65	0.2-20	0.04-0.17	6.1-8.4	Low	0.28			
Alfic Haplorthods, sandy	0-4	1-5	1.30-1.55	6.0-20	0.07-0.09	4.5-6.0	Low	0.15	5	1	2-5
	4-42	1-10	1.35-1.65	6.0-20	0.06-0.11	5.6-7.3	Low	0.15			
	42-52	20-40	1.45-1.60	0.2-0.6	0.16-0.20	5.6-7.3	Moderate	0.32			
	52-99	1-18	1.40-1.60	6.0-20	0.05-0.13	5.6-7.3	Low	0.17			
240C*	0-2	5-10	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-5
Entic	2-36	5-10	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
Haplorthods,	36-99	5-10	1.50-1.65	6.0-20	0.02-0.04	5.6-7.3	Low	0.15			
sandy											
241B*	0-3	5-10	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-5
Entic	3-47	5-10	1.40-1.60	6.0-20	0.05-0.08	4.5-6.5	Low	0.15			
Haplorthods,	47-60	5-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low	0.15			
sandy	60-99	5-40	1.55-1.70	0.6-20	0.04-0.10	5.6-7.3	Low	0.17			
245B*, 245C*, 245D*	0-2	5-10	1.30-1.55	6.0-20	0.07-0.09	4.5-6.5	Low	0.15	5	1	1-5
Entic	2-40	5-10	1.40-1.60	6.0-20	0.04-0.06	4.5-6.5	Low	0.15			
Haplorthods,	40-45	5-10	1.50-1.65	6.0-20	0.02-0.04	5.6-7.3	Low	0.15			
sandy	45-60	20-40	1.30-1.65	0.2-0.6	0.14-0.16	5.6-8.4	Moderate	0.37			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
250*:											
Mollic Psammaquents---	0-3	---	0.30-0.50	2.0-6.0	0.35-0.45	4.5-7.3	-------------	----	5	5	50-60
	3-8	5-15	1.30-1.60	2.0-6.0	0.16-0.18	4.5-7.3	Low----------	0.24			
	8-20	1-10	1.45-1.65	6.0-20	0.06-0.08	4.5-7.3	Low----------	0.15			
	20-60	1-10	1.50-1.70	6.0-20	0.05-0.07	5.6-7.3	Low----------	0.15			
Aquic Udipsamments---	0-3	0-5	1.20-1.55	6.0-20	0.08-0.10	5.1-6.5	Low----------	0.15	5	1	2-6
	3-7	0-10	1.40-1.60	6.0-20	0.07-0.09	5.1-6.0	Low----------	0.15			
	7-41	0-5	1.40-1.60	6.0-20	0.06-0.08	5.1-6.0	Low----------	0.15			
	41-60	0-5	1.50-1.65	6.0-20	0.04-0.06	5.1-6.0	Low----------	0.15			
Medisaprists, euic-----------	0-51	---	---	---	---	4.5-7.8	-------------	----	5	2	70-90
	51-60	---	---	---	---	---	-------------	----			
262A*------------	0-5	0-5	1.20-1.50	6.0-20	0.07-0.09	3.6-5.5	Low----------	0.15	2	1	2-7
Aeric	5-11	0-5	1.35-1.50	6.0-20	0.06-0.08	3.6-5.5	Low----------	0.15			
Haplaquods,	11-17	0-5	1.75-2.00	0.2-0.6	0.02-0.06	3.6-5.5	Low----------	0.15			
sandy, ortstein	17-60	0-5	1.50-1.60	6.0-20	0.02-0.06	4.5-6.0	Low----------	0.15			
263A*------------	0-3	0-5	1.20-1.55	6.0-20	0.08-0.10	5.1-6.5	Low----------	0.15	5	1	2-6
Aquic	3-7	0-10	1.40-1.60	6.0-20	0.07-0.09	5.1-6.0	Low----------	0.15			
Udipsamments	7-41	0-5	1.40-1.60	6.0-20	0.06-0.08	5.1-6.0	Low----------	0.15			
	41-60	0-5	1.50-1.65	6.0-20	0.04-0.06	5.1-6.0	Low----------	0.15			
272*-------------	0-6	0-5	1.20-1.50	6.0-20	0.08-0.10	4.5-6.5	Low----------	0.15	5	1	4-8
Typic Haplaquods	6-25	0-5	1.45-1.65	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15			
	25-60	0-5	1.50-1.65	6.0-20	0.04-0.06	4.5-6.5	Low----------	0.15			
273*-------------	0-3	---	0.30-0.50	2.0-6.0	0.35-0.45	4.5-7.3	-------------	----	5	5	50-60
Mollic	3-8	5-18	1.30-1.60	2.0-6.0	0.16-0.18	4.5-7.3	Low----------	0.24			
Psammaquents	8-20	2-10	1.45-1.65	6.0-20	0.06-0.08	4.5-7.3	Low----------	0.15			
	20-60	2-10	1.50-1.70	6.0-20	0.05-0.07	5.6-7.3	Low----------	0.15			
274*-------------	0-2	---	0.30-0.40	6.0-20	0.35-0.45	6.1-8.4	-------------	----	5	2	50-70
Typic	2-10	0-10	1.30-1.50	6.0-20	0.10-0.12	6.1-8.4	Low----------	0.17			
Haplaquolls,	10-20	0-10	1.40-1.55	6.0-20	0.06-0.11	6.1-8.4	Low----------	0.17			
sandy over	20-60	12-40	1.50-1.70	0.2-0.6	0.18-0.20	7.4-8.4	Moderate-----	0.37			
loamy											
280*:											
Aquents---------	0-60	---	---	---	---	---	-------------	----	---	---	---
Histosols-------	0-51	---	---	0.2-6.0	---	---	-------------	----	2	8	50-70
	51-60	---	---	---	---	---	-------------	----			
281--------------	0-51	---	0.15-0.25	0.2-6.0	0.35-0.45	3.6-4.4	-------------	----	5	2	>70
Medisaprists,	51-60	---	---	---	---	---	-------------	----			
dysic											
282--------------	0-51	---	0.15-0.25	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	5	2	>70
Medisaprists,	51-60	---	---	---	---	---	-------------	----			
euic											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding," "water table," and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
10B, 10C, 10D, 10E Perrinton	C	None	---	---	>6.0	---	---	---	---	Moderate	High	Moderate.
11A Ithaca	C	None	---	---	1.0-2.0	Apparent	Oct-May	---	---	High	High	Moderate.
12 Bono	D	None	---	---	+1-1.0	Apparent	Dec-May	---	---	Moderate	High	Low.
13B, 13C, 13D Marlette	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
14B Capac	C	None	---	---	1.0-2.0	Apparent	Nov-May	---	---	High	High	Low.
16B, 16C, 16D Remus	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
17B*, 17C*, 17D*:												
Marlette	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
Fern	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
18B*, 18C*, 18D*:												
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
Gowdy	B	None	---	---	>6.0	---	---	---	---	Moderate	High	Low.
20B*, 20C*, 20D*:												
Arkport	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
Chelsea	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
21A Freesoil	B	None	---	---	0.5-1.5	Apparent	Nov-May	---	---	High	High	Low.
22B, 22C Gowdy	B	None	---	---	>6.0	---	---	---	---	Moderate	High	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
23A Arkona	B	None	---	---	1.0-2.0	Perched	Nov-May	---	---	Moderate	High	Moderate.
24 Sickles	B/D	None	---	---	+1-1.0	Apparent	Dec-May	---	---	Moderate	High	Low.
25B*, 25C*, 25D*, 25E*:												
Gowdy	B	None	---	---	>6.0	---	---	---	---	Moderate	High	Low.
Perrinton	C	None	---	---	>6.0	---	---	---	---	Moderate	High	Moderate.
26A*:												
Arkona	B	None	---	---	1.0-2.0	Perched	Nov-May	---	---	Moderate	High	Moderate.
Ithaca	C	None	---	---	1.0-2.0	Apparent	Oct-May	---	---	High	High	Moderate.
27B*:												
Arkona	B	None	---	---	1.0-2.0	Perched	Nov-May	---	---	Moderate	High	Moderate.
Del Rey	C	None	---	---	1.0-3.0	Apparent	Jan-May	---	---	High	High	Moderate.
28B, 28C, 28D Fern	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
29A Dixboro	B	None	---	---	1.0-2.0	Apparent	Nov-Apr	---	---	High	Moderate	Moderate.
30 Lamson	B/D	None	---	---	+1-0.5	Apparent	Dec-May	---	---	High	High	Low.
35B*, 35C*, 35D*:												
Alvin	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	High.
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
36A Del Rey	C	None	---	---	1.0-3.0	Apparent	Jan-May	---	---	High	High	Moderate.
37A Altmar	B	None	---	---	0.5-1.5	Apparent	Dec-May	---	---	Moderate	Low	Moderate.
38B*, 38C*, 38D*, 38E*:												
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
Okee	B	None	---	---	>6.0	---	---	---	---	Low	Moderate	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
40B*, 40C*, 40D*:												
Coloma	A	None	---	---	>6.0	---	---	---	---	Low	Low	Moderate.
Toogood	A	None	---	---	>6.0	---	---	---	---	Low	Low	Moderate.
41 Granby	A/D	None	---	---	+1-1.0	Apparent	Nov-Jun	---	---	Moderate	High	Low.
42B*, 42C*, 42D*, 42E*:												
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
Remus	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
Fern	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
43B, 43C, 43D, 43E Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
44B Thetford	A	None	---	---	1.0-2.0	Apparent	Feb-May	---	---	Moderate	Low	Moderate.
45B*, 45C*, 45D*, 45E*, 45F*:												
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
Benona	A	None	---	---	>6.0	---	---	---	---	Low	Low	High.
46B Grattan	A	None	---	---	>6.0	---	---	---	---	Low	Low	High.
48A*:												
Saugatuck	C	None	---	---	0.5-2.0	Apparent	Nov-May	---	---	Moderate	Low	Moderate.
Jebavy	A/D	None	---	---	+1-1.0	Apparent	Oct-Jun	---	---	Moderate	High	High.
49B, 49B3, 49C, 49C3, 49E, 49F Grattan	A	None	---	---	>6.0	---	---	---	---	Low	Low	High.
50B Covert	A	None	---	---	2.0-3.5	Apparent	Nov-Apr	---	---	Low	Low	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
51B Pipestone	B	None	---	---	0.5-1.5	Apparent	Oct-Jun	---	---	Moderate	Low	Moderate.
52 Granby	A/D	None	---	---	+1-1.0	Apparent	Nov-Jun	---	---	Moderate	High	Low.
53B, 53C Grattan	A	None	---	---	>6.0	---	---	---	---	Low	Low	High.
56B, 56C, 56E Benona	A	None	---	---	>6.0	---	---	---	---	Low	Low	High.
57C, 57F Nordhouse	A	None	---	---	>6.0	---	---	---	---	Low	Low	Moderate.
58 Kingsville	A/D	None	---	---	+1-1.0	Apparent	Jan-Apr	---	---	Moderate	High	High.
59B, 59C, 59E Benona	A	None	---	---	>6.0	---	---	---	---	Low	Low	High.
60B, 60C, 60E Coloma	A	None	---	---	>6.0	---	---	---	---	Low	Low	Moderate.
61B, 61C, 61E Epworth	A	None	---	---	>6.0	---	---	---	---	Low	Low	Moderate.
62B, 62C Plainfield	A	None	---	---	>6.0	---	---	---	---	Low	Low	High.
65 Sloan	B/D	Frequent	Brief	Nov-Jun	0-1.0	Apparent	Nov-Jun	---	---	High	High	Low.
67 Cohoctah	B/D	Occasional	Brief to long.	Nov-Apr	0-1.0	Apparent	Sep-May	---	---	High	High	Low.
69 Algansee	B	Occasional	Long	Nov-May	1.0-2.0	Apparent	Nov-May	---	---	Moderate	Low	Low.
70 Glendora	A/D	Frequent	Long	Jan-Dec	0-1.0	Apparent	Nov-Jun	---	---	Moderate	High	Moderate.
71*:												
Houghton	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	6-18	55-60	High	High	Moderate.
Carlisle	A/D	None	---	---	+.5-1.0	Apparent	Sep-Jun	6-18	43-54	High	High	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
72---------------- Adrian	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	6-18	29-33	High-----	High-----	Moderate.
73---------------- Palms	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	4-15	25-32	High-----	High-----	Moderate.
75---------------- Martisco	B/D	None--------	---	---	+1-0.5	Apparent	Oct-Jun	3-4	4-6	High-----	High-----	Low.
77---------------- Napoleon	A/D	None--------	---	---	+1-1.0	Apparent	Sep-Jun	22-26	50-59	High-----	Moderate	High.
83*:												
Histosols--------	D	None--------	---	---	+1-1.0	Apparent	Sep-Jun	---	---	High-----	High-----	Moderate.
Aquents----------	D	None--------	---	---	+1-1.0	Apparent	Jan-Dec	---	---	High-----	---	---
84F*: Dune land.												
Quartzipsamments-	A	None--------	---	---	>6.0	---	---	---	---	---	Low------	Moderate.
Psammaquents-----	D	None--------	---	---	+1-1.0	Apparent	Oct-May	---	---	Moderate	High-----	High.
85F*:												
Udorthents-------	---	None--------	---	---	>6.0	---	---	---	---	---	---	---
Quartzipsamments-	A	None--------	---	---	>6.0	---	---	---	---	---	Low------	Moderate.
86F*: Dune land.												
Quartzipsamments-	A	None--------	---	---	>6.0	---	---	---	---	---	Low------	Moderate.
87. Beaches												
88A--------------- Udipsamments	A	None--------	---	---	>6.0	---	---	---	---	Low------	Low------	Moderate.
89A--------------- Udorthents	---	None--------	---	---	>6.0	---	---	---	---	---	---	---
91. Pits, sand and gravel												

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
92B, 92C Chelsea	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
96B*, 96C*, 96D*, 96E*:												
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
Tekenink	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
97*:												
Kerston	A/D	Frequent	Long	Mar-May	+1-1.0	Apparent	Sep-Jun	6-12	18-20	High	High	Low.
Carlisle	A/D	Frequent	Very brief to long.	Nov-Apr	+.5-1.0	Apparent	Sep-Jun	4-18	43-54	High	High	Low.
98B*, 98C*, 98D*:												
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
Scalley	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
99B*:												
Nappanee	D	None	---	---	1.0-2.0	Perched	Nov-May	---	---	Moderate	High	Low.
Hoytville	C/D	None	---	---	+1-1.0	Perched	Jan-Apr	---	---	High	High	Low.
100B Nappanee	D	None	---	---	1.0-2.0	Perched	Nov-May	---	---	Moderate	High	Low.
101B, 101C Claybanks	C	None	---	---	>6.0	---	---	---	---	Moderate	High	Moderate.
210B*, 210C*, 210D*, 211B*, 211C* Typic Udipsamments	A	None	---	---	>15	---	---	---	---	Low	Low	High.
212B* Typic Udipsamments	A	None	---	---	5.0-15	Apparent	Jan-Dec	---	---	Low	Low	High.
213B*, 213C*, 213D* Argic Udipsamments	A	None	---	---	>15	---	---	---	---	Low	Low	High.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
220B*, 220C*, 220D*, 220E*, 221B*, 221C*, 221D*, 221E* Entic Haplorthods, sandy	A	None	---	---	>15	---	---	---	---	Low	Low	High.
222B*, 222C* Entic Haplorthods, sandy	A	None	---	---	5.0-15	Apparent	Jan-Dec	---	---	Low	Low	High.
223B*, 223C*, 223D*, 223E* Entic Haplorthods, sandy	A	None	---	---	>15	---	---	---	---	Low	Low	High.
224B* Entic Haplorthods, sandy	A	None	---	---	3.0-5.0	Apparent	Jan-Dec	---	---	Low	Low	High.
225B*, 225C*, 225D*, 230B*, 230C*, 230D*, 230E* Entic Haplorthods, sandy	A	None	---	---	>15	---	---	---	---	Low	Low	High.
231B*:												
Entic Haplorthods, sandy	A	None	---	---	>15	---	---	---	---	Low	Low	High.
Alfic Haplorthods, sandy over loamy	A	None	---	---	>15	---	---	---	---	Low	Moderate	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
233B*, 233C*, 233D*, 233E*:												
Alfic Haplorthods, sandy over loamy	A	None	---	---	>15	---	---	---	---	Low	Moderate	Moderate.
Entic Haplorthods, sandy	A	None	---	---	>15	---	---	---	---	Low	Low	High.
235B*:												
Alfic Haplorthods, sandy over loamy	A	None	---	---	>15	---	---	---	---	Low	Moderate	Moderate.
Alfic Haplorthods, sandy	A	None	---	---	>15	---	---	---	---	Low	Low	Moderate.
235C*:												
Alfic Haplorthods, sandy over loamy	A	None	---	---	>15	---	---	---	---	Low	Moderate	Moderate.
Alfic Haplorthods, sandy	A	None	---	---	>15	---	---	---	---	Low	Low	Moderate.
240C*, 241B*, 245B*, 245C*, 245D* Entic Haplorthods, sandy	A	None	---	---	>15	---	---	---	---	Low	Low	High.
250*:												
Mollic Psammaquents	D	Occasional	Brief	Oct-May	+1-1.0	Apparent	Nov-May	---	---	Moderate	High	High.
Aquic Udipsamments	A	Occasional	Brief	Oct-May	1.5-3.5	Apparent	Nov-Apr	---	---	Low	Low	High.
Medisaprists, euic	D	Occasional	Brief	Oct-May	+1-1.0	Apparent	Sep-Jun	---	---	High	High	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
262A*: Aeric Haplaquods, sandy, ortstein	C	None	---	---	0.5-2.5	Apparent	Oct-Jun	---	---	Moderate	High	High.
263A*: Aquic Udipsamments	A	None	---	---	1.5-3.5	Apparent	Nov-May	---	---	Low	Low	High.
272*: Typic Haplaquods, sandy	D	None	---	---	+1-1.5	Apparent	Nov-May	---	---	Moderate	Moderate	High.
273*: Mollic Psammaquents	D	None	---	---	+1-1.0	Apparent	Nov-May	---	---	Moderate	High	High.
274*: Typic Haplaquolls, sandy over loamy	D	None	---	---	+1-1.0	Apparent	Nov-May	---	---	High	Moderate	Low.
280*:												
Aquents	D	None	---	---	+1-1.0	Apparent	Jan-Dec	---	---	High	---	---
Histosols	D	None	---	---	+1-1.0	Apparent	Sep-Jun	---	---	High	High	Moderate.
281: Medisaprists, dysic	D	None	---	---	+1-1.0	Apparent	Sep-Jun	---	---	High	High	High.
282: Medisaprists, euic	D	None	---	---	+1-1.0	Apparent	Sep-Jun	---	---	High	High	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Aeric Haplaquods, sandy, ortstein	Sandy, mixed, mesic, ortstein Aeric Haploquods
Alfic Haplorthods, sandy	Sandy, mixed, mesic Alfic Haplorthods
Alfic Haplorthods, sandy over loamy	Sandy over loamy, mixed, mesic Alfic Haplorthods
Algansee	Mixed, mesic Aquic Udipsamments
Altmar	Mixed, mesic Aquic Udipsamments
Alvin	Coarse-loamy, mixed, mesic Typic Hapludalfs
Aquents	Aquents
Aquic Udipsamments	Mixed, mesic Aquic Udipsamments
Argic Udipsamments	Mixed, mesic Argic Udipsamments
Arkona	Sandy over clayey, mixed, mesic Alfic Epiaquods
Arkport	Coarse-loamy, mixed, mesic Psammentic Hapludalfs
Benona	Sandy, mixed, mesic Entic Haplorthods
Bono	Fine, illitic, mesic Typic Endoaquolls
Capac	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Carlisle	Euic, mesic Typic Medisaprists
Chelsea	Mixed, mesic Argic Udipsamments
Claybanks	Fine, mixed, mesic Haplic Glossudalfs
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Coloma	Mixed, mesic Argic Udipsamments
Covert	Sandy, mixed, mesic Oxyaquic Haplorthods
Del Rey	Fine, illitic, mesic Aeric Ochraqualfs
Dixboro	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Entic Haplorthods, sandy	Sandy, mixed, mesic Entic Haplorthods
Epworth	Sandy, siliceous, mesic Entic Haplorthods
Fern	Sandy over loamy, mixed, mesic Psammentic Argiudolls
Freesoil	Coarse-loamy, mixed, mesic Aquic Eutrochrepts
Glendora	Mixed, mesic Mollic Psammaquents
Gowdy	Clayey, mixed, mesic Arenic Glossudalfs
Granby	Sandy, mixed, mesic Typic Haplaquolls
Grattan	Sandy, mixed, mesic Entic Haplorthods
Histosols	Histosols
Houghton	Euic, mesic Typic Medisaprists
Hoytville	Fine, illitic, mesic Mollic Ochraqualfs
Ithaca	Fine, mixed, mesic Aquic Glossudalfs
Jebavy	Sandy, mixed, mesic, ortstein Aeric Haplaquods
Kerston	Euic, mesic Fluvaquentic Medisaprists
Kingsville	Mixed, mesic Mollic Psammaquents
Lamson	Coarse-loamy, mixed, nonacid, mesic Aeric Haplaquepts
Marlette	Fine-loamy, mixed, mesic Haplic Glossudalfs
Martisco	Fine-silty, carbonatic, mesic Histic Humaquepts
Medisaprists	Medisaprists
Mollic Psammaquents	Mixed, mesic Mollic Psammaquents
Napoleon	Dysic, mesic Typic Medihemists
Nappanee	Fine, illitic, mesic Aeric Ochraqualfs
Nordhouse	Mesic, uncoated Spodic Quartzipsamments
Okee	Loamy, mixed, mesic Arenic Hapludalfs
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Perrinton	Fine, mixed, mesic Haplic Glossudalfs
Pipestone	Sandy, mixed, mesic Entic Haplaquods
Plainfield	Mixed, mesic Typic Udipsamments
Psammaquents	Psammaquents
Quartzipsamments	Quartzipsamments
Remus	Fine-loamy, mixed, mesic Haplic Glossudalfs
Saugatuck	Sandy, mixed, mesic, ortstein Aeric Haplaquods
Scalley	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Haplic Glossudalfs
Sickles	Sandy over clayey, mixed, nonacid, mesic Mollic Haplaquents
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs

TABLE 19.--CLASSIFICATION OF THE SOILS--Continued

Soil name	Family or higher taxonomic class
Tekenink	Coarse-loamy, mixed, mesic Typic Glossudalfs
Thetford	Sandy, mixed, mesic Psammaquentic Hapludalfs
Toogood	Sandy, mixed, mesic Arenic Eutrochrepts
Typic Haplaquods, sandy	Sandy, mixed, mesic Typic Haplaquods
Typic Haplaquolls, sandy over loamy	Sandy over loamy, mixed, mesic Typic Haplaquolls
Typic Udipsamments	Mixed, mesic Typic Udipsamments
Udipsamments	Udipsamments
Udorthents	Udorthents

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
10B-------------------- Perrinton	IIe	Yes	4A	1.5a
10C-------------------- Perrinton	IIIe	---	4A	1.5a
10D-------------------- Perrinton	IVe	---	4A	1.5a
10E-------------------- Perrinton	VIIe	---	4R	1.5a
11A-------------------- Ithaca	IIe	Yes*	4W	1.5b
12--------------------- Bono	IIIw	Yes*	4W	1.5c
13B-------------------- Marlette	IIe	Yes	3A	1.5a
13C-------------------- Marlette	IIIe	---	3A	1.5a
13D-------------------- Marlette	IVe	---	3A	1.5a
14B-------------------- Capac	IIe	Yes*	4W	1.5b
16B-------------------- Remus	IIe	Yes	3A	2.5a
16C-------------------- Remus	IIIe	---	3A	2.5a
16D-------------------- Remus	IVe	---	3A	2.5a
17B--------------------	IIe	Yes		
Marlette--------------			3A	1.5a
Fern------------------			4S	4/2a
17C--------------------	IIIe	---		
Marlette--------------			3A	1.5a
Fern------------------			4S	4/2a
17D--------------------	IVe	---		
Marlette			3A	1.5a
Fern------------------			4S	4/2a
18B--------------------	IIIs	---		
Spinks----------------			4A	4a
Gowdy-----------------			3A	4/1a
18C--------------------	IIIe	---		
Spinks----------------			4A	4a
Gowdy-----------------			3A	4/1a

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
18D	IVe	---		
Spinks			4A	4a
Gowdy			3A	4/1a
20B	IIe	Yes		
Arkport			3A	3a-s
Chelsea			5S	5a
20C	IIIe	---		
Arkport			3A	3a-s
Chelsea			5S	5a
20D	IVe	---		
Arkport			3A	3a-s
Chelsea			5S	5a
21A Freesoil	IIIw	Yes*	3W	3b-s
22B Gowdy	IIIe	Yes	3A	4/1a
22C Gowdy	IVe	---	3A	4/1a
23A Arkona	IIIw	---	2W	4/1b
24 Sickles	Vw	---	5W	4/c
25B	IIIe	Yes		
Gowdy			3A	4/1a
Perrinton			4A	1.5a
25C	IVe	---		
Gowdy			3A	4/1a
Perrinton			4A	1.5a
25D	IVe	---		
Gowdy			3A	4/1a
Perrinton			4A	1.5a
25E	VIIe	---		
Gowdy			3R	4/1a
Perrinton			4R	1.5a
26A	IIIw	---		
Arkona			2W	4/1b
Ithaca			4W	1.5b
27B	IIIw	---		
Arkona			2W	4/1b
Del Rey			3C	1.5b
28B Fern	IIIe	---	4S	4/2a
28C Fern	IIIe	---	4S	4/2a

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
28D Fern	IVe	---	4S	4/2a
29A Dixboro	IIw	Yes*	4W	3b-s
30 Lamson	IIIw	Yes*	8W	3c-s
35B	IIe	Yes		
Alvin			5A	3/5a
Spinks			4A	4a
35C	IIIe	---		
Alvin			5A	3/5a
Spinks			4A	4a
35D	IVe	---		
Alvin			5A	3/5a
Spinks			4A	4a
36A Del Rey	IIw	Yes*	3C	1.5b
37A Altmar	IVw	---	3W	4b
38B	IIIs	---		
Spinks			4A	4a
Okee			2A	4/2a
38C	IIIe	---		
Spinks			4A	4a
Okee			2A	4/2a
38D	VIIe	---		
Spinks			4A	4a
Okee			2A	4/2a
38E	VIIe	---		
Spinks			4R	4a
Okee			2R	4/2a
40B	IVs	---		
Coloma			2S	5a
Toogood			6A	4/Ga
40C	VIs	---		
Coloma			2S	5a
Toogood			6A	4/Ga
40D	VIs	---		
Coloma			2S	5a
Toogood			6A	4/Ga
41 Granby	Vw	---	2W	5C
42B	IIIs	---		
Spinks			4A	4a
Remus			3A	2.5a
Fern			4S	4/2a

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
42C	IIIe	---		
Spinks			4A	4a
Remus			3A	2.5a
Fern			4S	4/2a
42D	IVe	---		
Spinks			4A	4a
Remus			3A	2.5a
Fern			4S	4/2a
42E	VIIe	---		
Spinks			4R	4a
Remus			3R	2.5a
Fern			4R	4/2a
43B Spinks	IIIs	---	4A	4a
43C Spinks	IIIe	---	4A	4a
43D Spinks	IVe	---	4A	4a
43E Spinks	VIIe	---	4R	4a
44B Thetford	IIIw	---	3W	4b
45B	IIIs	---		
Spinks			4A	4a
Benona			4S	5a
45C	IIIe	---		
Spinks			4A	4a
Benona			4S	5a
45D	IVe	---		
Spinks			4A	4a
Benona			4S	5a
45E	VIIe	---	4R	
Spinks				4a
Benona				5a
45F	VIIe	---	4R	
Spinks				4a
Benona				5a
46B Grattan	IVs	---	3S	5a
48A	IVw	---	2W	
Saugatuck				5b-h
Jebavy				5c-h
49B Grattan	VIs	---	9S	5.3a

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
49B3------------------ Grattan	VIIs	---	9S	5.3a
49C------------------- Grattan	VIs	---	9S	5.3a
49C3------------------ Grattan	VIIs	---	9S	5.3a
49E------------------- Grattan	VIIs	---	9R	5.3a
49F------------------- Grattan	VIIs	---	9R	5.3a
50B------------------- Covert	IVs	---	4S	5a
51B------------------- Pipestone	IVw	---	3W	5b
52-------------------- Granby	IVw	---	2W	5c
53B------------------- Grattan	VIs	---	9S	5/2a
53C------------------- Grattan	VIs	---	9S	5/2a
56B------------------- Benona	IVs	---	3S	5a
56C------------------- Benona	VIs	---	3S	5a
56E------------------- Benona	VIIs	---	3R	5a
57C------------------- Nordhouse	VIIs	---	4S	5.7a
57F------------------- Nordhouse	VIIs	---	4R	5.7a
58-------------------- Kingsville	Vw	---	5W	5c
59B------------------- Benona	IVs	---	4S	5a
59C------------------- Benona	VIs	---	4S	5a
59E------------------- Benona	VIIs	---	4R	5a
60B------------------- Coloma	IVs	---	2S	5a

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
60C-------------------- Coloma	VIs	---	2S	5a
60E-------------------- Coloma	VIIs	---	2R	5a
61B-------------------- Epworth	IIIs	---	4S	5.3a
61C-------------------- Epworth	IVe	---	4S	5.3a
61E-------------------- Epworth	VIe	---	4R	5.3a
62B-------------------- Plainfield	IVs	---	8S	5.3a
62C-------------------- Plainfield	VIIs	---	8S	5.3a
65--------------------- Sloan	IIIw	Yes**	3W	L-2c
67--------------------- Cohoctah	Vw	Yes*	2W	L-2c
69--------------------- Algansee	IIIw	---	4W	L-4c
70--------------------- Glendora	VIw	---	3W	L-4c
71--------------------- Houghton and Carlisle	Vw	---	2W	Mc
72--------------------- Adrian	Vw	---	2W	M/4c
73--------------------- Palms	Vw	---	2W	M/3c
75--------------------- Martisco	Vw	---	2W	M/mc
77--------------------- Napoleon	VIw	---	3W	Mc-ay
83. Histosols and Aquents				
84F. Dune land- Quartzipsamments- Psammaquents				
85F. Udorthents- Quartzipsamments				

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
86F. Dune land-Quartzipsamments				
87. Beaches				
88A. Udipsamments				
89A. Udorthents				
91. Pits, sand and gravel				
92B	IVs	---	5S	5a
Chelsea				
92C	VIs	---	5S	5a
Chelsea				
96B	IIIs	---	4A	
Spinks				4a
Tekenink				3a
96C	IIIe	---	4A	
Spinks				4a
Tekenink				3a
96D	IVe	---	4A	
Spinks				4a
Tekenink				3a
96E	VIIe	---	4R	
Spinks				4a
Tekenink				3a
97	Vw	---	2W	
Kerston				L-Mc
Carlisle				Mc
98B	IIIs	---		
Spinks			4A	4a
Scalley			3A	3/5a
98C	IIIe	---		
Spinks			4A	4a
Scalley			3A	3/5a
98D	IVe	---		
Spinks			4A	4a
Scalley			3A	3/5a
99B	IIIe	Yes*		
Nappanee			4C	1b
Hoytville			3W	1c
100B	IIIe	Yes*	4C	1b
Nappanee				

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
101B------------------- Claybanks	IIIe	Yes	4A	1a
101C------------------- Claybanks	IIIe	---	4A	1a
210B------------------- Typic Udipsamments	VIs	---	2S	5.7a
210C------------------- Typic Udipsamments	VIIs	---	2S	5.7a
210D------------------- Typic Udipsamments	VIIs	---	2R	5.7a
211B------------------- Typic Udipsamments	VIs	---	3S	5.7a
211C------------------- Typic Udipsamments	VIIs	---	3S	5.7a
212B------------------- Typic Udipsamments	VIs	---	3S	5.3a
213B------------------- Argic Udipsamments	IVs	---	---	5.3a
213C------------------- Argic Udipsamments	VIs	---	---	5.3a
213D------------------- Argic Udipsamments	VIs	---	---	5.3a
220B------------------- Entic Haplorthods, sandy	VIs	---	4S	5.3a
220C------------------- Entic Haplorthods, sandy	VIIs	---	4S	5.3a
220D------------------- Entic Haplorthods, sandy	VIIs	---	4R	5.3a
220E------------------- Entic Haplorthods, sandy	VIIs	---	4R	5.3a
221B------------------- Entic Haplorthods, sandy	VIs	---	4S	5.3a
221C------------------- Entic Haplorthods, sandy	VIIs	---	4S	5.3a
221D------------------- Entic Haplorthods, sandy	VIIs	---	4R	5.3a

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
221E------------------ Entic Haplorthods, sandy	VIIs	---	4R	5.3a
222B------------------ Entic Haplorthods, sandy	VIs	---	4S	5.3a
222C------------------ Entic Haplorthods, sandy	VIIs	---	4S	5.3a
223B------------------ Entic Haplorthods, sandy	VIs	---	4S	5.3a
223C------------------ Entic Haplorthods, sandy	VIIs	---	4S	5.3a
223D------------------ Entic Haplorthods, sandy	VIIs	---	4R	5.3a
223E------------------ Entic Haplorthods, sandy	VIIs	---	4R	5.3a
224B------------------ Entic Haplorthods, sandy	IVs	---	4S	5a
225B------------------ Entic Haplorthods, sandy	VIs	---	---	5.3a
225C------------------ Entic Haplorthods, sandy	VIIs	---	---	5.3a
225D------------------ Entic Haplorthods, sandy	VIIs	---	---	5.3a
230B------------------ Entic Haplorthods, sandy	VIs	---	4S	5.3a
230C------------------ Entic Haplorthods, sandy	VIIs	---	4S	5.3a
230D------------------ Entic Haplorthods, sandy	VIIs	---	4R	5.3a
230E------------------ Entic Haplorthods, sandy	VIIs	---	4R	5.3a

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
231B	VIs	---		
Entic Haplorthods, sandy			4S	5.3a
Alfic Haplorthods, sandy over loamy			5S	5.2a
233B	IIIs	---		
Alfic Haplorthods, sandy over loamy			5S	5.2a
Entic Haplorthods, sandy			4S	5.3a
233C	IVe	---		
Alfic Haplorthods, sandy over loamy			5S	5.2a
Entic Haplorthods, sandy			4S	5.3a
233D	VIe	---		
Alfic Haplorthods, sandy over loamy			5R	5.2a
Entic Haplorthods, sandy			4R	5.3a
233E	VIIe	---		
Alfic Haplorthods, sandy over loamy			5R	5.2a
Entic Haplorthods, sandy			4R	5.3a
235B	IIIs	---		
Alfic Haplorthods, sandy over loamy			5S	5.2a
Alfic Haplorthods, sandy			3S	5.3a
235C	IVe	---		
Alfic Haplorthods, sandy over loamy			5S	5.2a
Alfic Haplorthods, sandy			3S	5.3a
240C Entic Haplorthods, sandy	VIs	---	3S	5a
241B Entic Haplorthods, sandy	IVs	---	3S	5a
245B Entic Haplorthods, sandy	IVs	---	3S	5/2a

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Woodland ordination symbol	Michigan soil management group
245C------------------ Entic Haplorthods, sandy	VIs	---	3S	5/2a
245D------------------ Entic Haplorthods, sandy	VIIs	---	3R	5/2a
250------------------- Mollic Psammaquents-- Aquic Udipsamments--- Medisaprists, euic---	Vw	---	 --- 4S ---	 5c 5b Mc
262A------------------ Aeric Haplaquods, sandy, ortstein	Vw	---	4W	5b-h
263A------------------ Aquic Udipsamments	IVs	---	---	5.3a
272------------------- Typic Haplaquods, sandy	VIw	---	---	5b-h
273------------------- Mollic Psammaquents	Vw	---	---	5c
274------------------- Mollic Haplaquolls, sandy over loamy	Vw	---	---	4/2c
280------------------- Aquents and Histosols	---	---	---	---
281------------------- Medisaprists, dysic	---	---	---	M/5c
282------------------- Medisaprists, euic	---	---	---	Mc

* Where drained.

** Where drained and either protected from flooding or not frequently flooded during the growing season.

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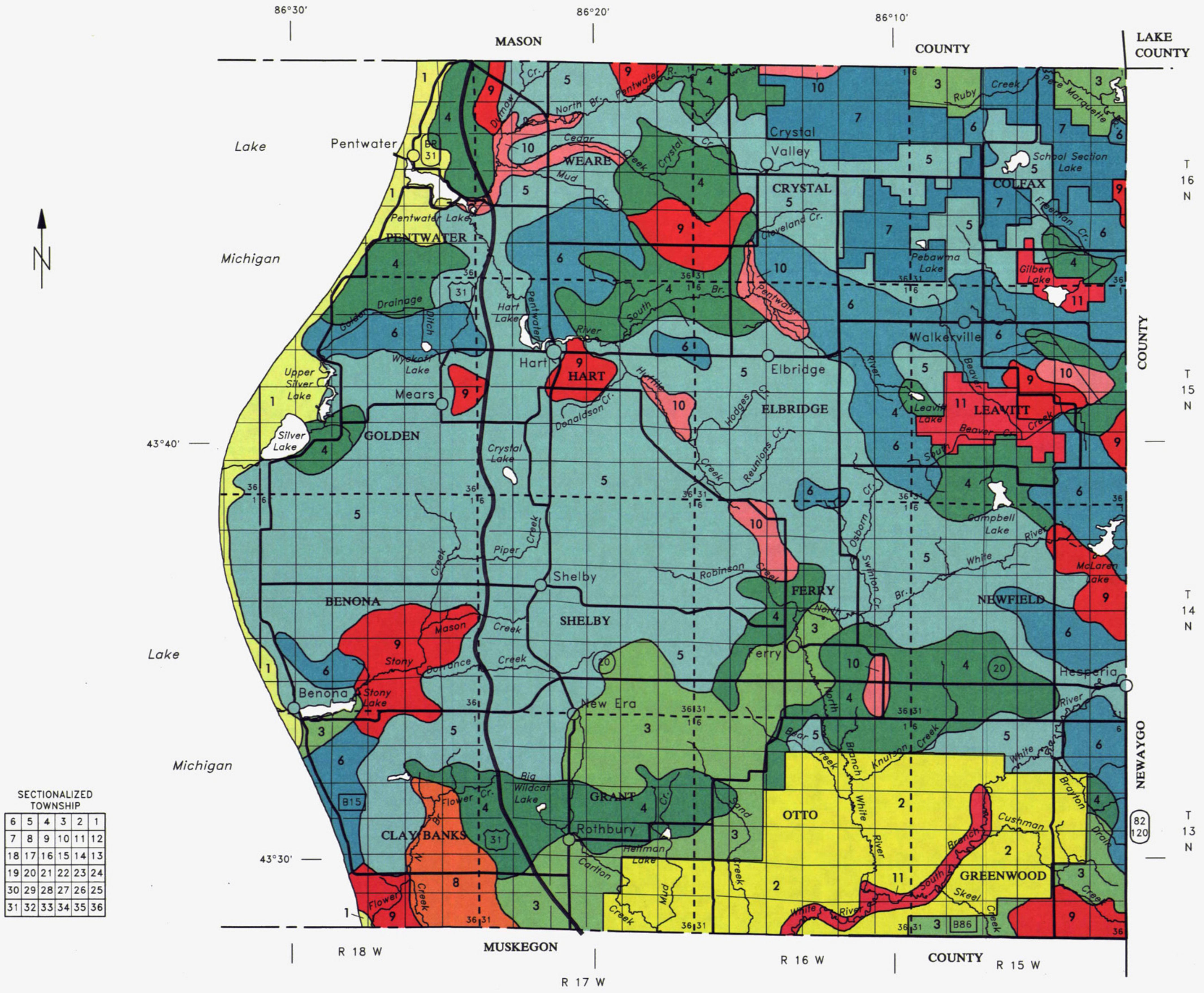


Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL LEGEND*

AREAS OF NEARLY LEVEL TO VERY STEEP, MODERATELY WELL DRAINED TO EXCESSIVELY DRAINED SOILS AND AREAS OF DUNE LAND

1	Epworth–Dune land–Nordhouse Association
2	Typic Udipsamments–Entic Haplorthods, sandy Association

AREAS OF NEARLY LEVEL TO VERY STEEP, EXCESSIVELY DRAINED, MODERATELY WELL DRAINED, AND POORLY DRAINED SOILS

3	Plainfield–Coloma–Grattan Association
4	Grattan–Covert–Granby Association

AREAS OF NEARLY LEVEL TO VERY STEEP, EXCESSIVELY DRAINED AND WELL DRAINED SOILS

5	Benona–Spinks–Grattan Association
6	Spinks–Remus–Fern Association
7	Entic Haplorthods, sandy–Alfic Haplorthods, sandy Association

AREAS OF NEARLY LEVEL TO STEEP, WELL DRAINED, SOMEWHAT POORLY DRAINED, AND VERY POORLY DRAINED SOILS

8	Claybanks–Nappanee–Hoytville Association
9	Perrinton–Gowdy–Ithaca Association

AREAS OF NEARLY LEVEL, VERY POORLY DRAINED AND POORLY DRAINED SOILS

10	Houghton–Kerston–Carlisle Association
11	Medisaprists, euic–Typic Haplaquolls, sandy over loamy–Mollic Psammaquents Association

* The units on this legend are described in the text under the heading "General Soil Map Units".

Compiled 1995

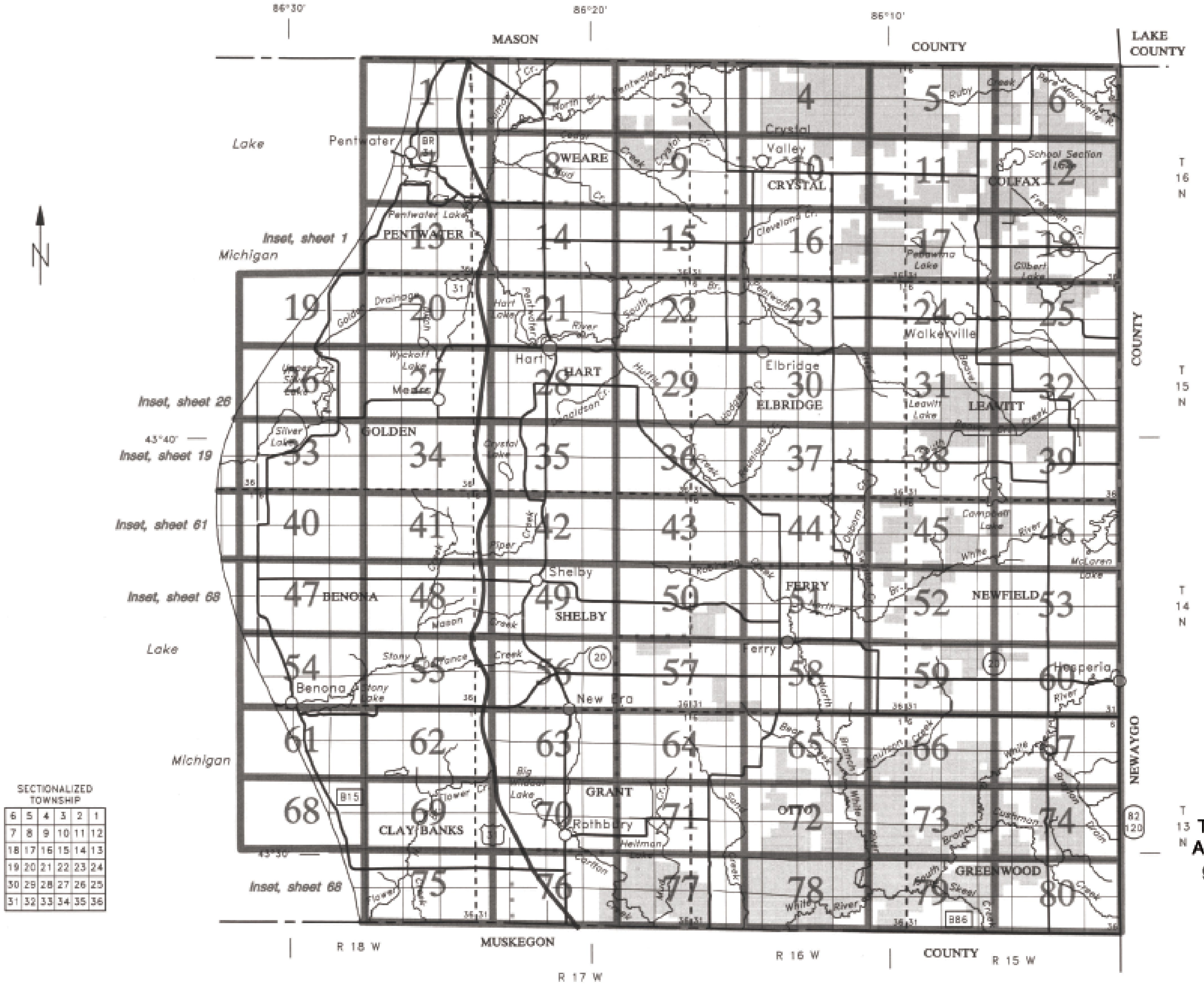
U. S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE AND FOREST SERVICE
IN COOPERATION WITH THE MICHIGAN DEPARTMENT OF AGRICULTURE
MICHIGAN AGRICULTURAL EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE
MICHIGAN TECHNOLOGICAL UNIVERSITY

GENERAL SOIL MAP
OCEANA COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 4 Miles

1 0 4 8 Km



▪ ▪ ▪ USFS Administrative Boundary

▨ USFS Property Mapped

Original text from each individual map sheet read:
This map is compiled on 1981 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS

OCEANA COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 4 Miles

1 0 4 8 Km

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OCEANA COUNTY, MICHIGAN

MICHIGAN DEPARTMENT OF AGRICULTURE
MICHIGAN AGRICULTURAL EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE
MICHIGAN TECHNOLOGICAL UNIVERSITY

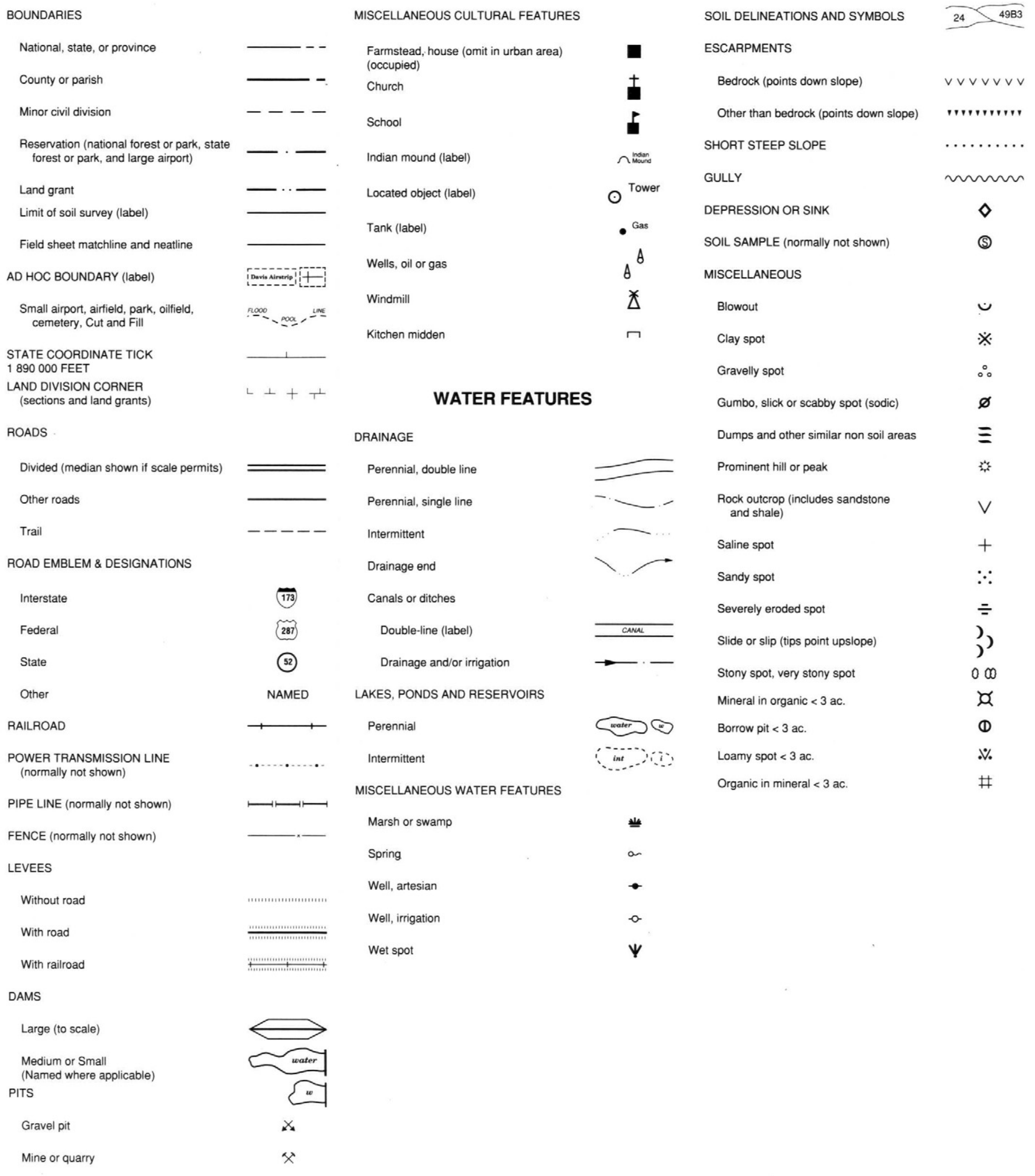
SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and letters. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 3 following the slope indicates that the soil is severely eroded. Mapping unit numbers from 210B through 282 are in the Manistee National Forest.

SYMBOL	NAME
10B	Perrinton loam, 2 to 6 percent slopes
10C	Perrinton loam, 6 to 12 percent slopes
10D	Perrinton loam, 12 to 18 percent slopes
10E	Perrinton loam, 18 to 35 percent slopes
11A	Ithaca loam, 0 to 3 percent slopes
12	Bono silt loam
13B	Marlette fine sandy loam, 2 to 6 percent slopes
13C	Marlette fine sandy loam, 6 to 12 percent slopes
13D	Marlette fine sandy loam, 12 to 18 percent slopes
14B	Capac fine sandy loam, 0 to 4 percent slopes
16B	Remus fine sandy loam, 1 to 6 percent slopes
16C	Remus fine sandy loam, 6 to 12 percent slopes
16D	Remus fine sandy loam, 12 to 18 percent slopes
17B	Marlette-Fern complex, 0 to 6 percent slopes
17C	Marlette-Fern complex, 6 to 12 percent slopes
17D	Marlette-Fern complex, 12 to 18 percent slopes
18B	Spinks-Gowdy loamy fine sands, 0 to 6 percent slopes
18C	Spinks-Gowdy loamy fine sands, 6 to 12 percent slopes
18D	Spinks-Gowdy loamy fine sands, 12 to 18 percent slopes
20B	Arkport-Chelsea complex, 0 to 6 percent slopes
20C	Arkport-Chelsea complex, 6 to 12 percent slopes
20D	Arkport-Chelsea complex, 12 to 18 percent slopes
21A	Freesoil loamy very fine sand, 0 to 3 percent slopes
22B	Gowdy loamy fine sand, 1 to 6 percent slopes
22C	Gowdy loamy fine sand, 6 to 12 percent slopes
23A	Arkona loamy fine sand, 0 to 3 percent slopes
24	Sickles loamy sand
25B	Gowdy-Perrinton complex, 1 to 6 percent slopes
25C	Gowdy-Perrinton complex, 6 to 12 percent slopes
25D	Gowdy-Perrinton complex, 12 to 18 percent slopes
25E	Gowdy-Perrinton complex, 18 to 35 percent slopes
26A	Arkona-Ithaca complex, 0 to 3 percent slopes
27B	Arkona-Del Rey complex, 0 to 4 percent slopes
28B	Fern loamy fine sand, 0 to 6 percent slopes
28C	Fern loamy fine sand, 6 to 12 percent slopes
28D	Fern loamy fine sand, 12 to 18 percent slopes
29A	Dixboro loamy very fine sand, 0 to 3 percent slopes
30	Lamson muck
35B	Alvin-Spinks complex, 0 to 6 percent slopes
35C	Alvin-Spinks complex, 6 to 12 percent slopes
35D	Alvin-Spinks complex, 12 to 18 percent slopes
36A	Del Rey silt loam, 0 to 3 percent slopes
37A	Altmar loamy fine sand, 0 to 3 percent slopes
38B	Spinks-Okee complex, 0 to 6 percent slopes
38C	Spinks-Okee complex, 6 to 12 percent slopes
38D	Spinks-Okee complex, 12 to 18 percent slopes
38E	Spinks-Okee complex, 18 to 35 percent slopes
40B	Coloma-Toogood complex, 0 to 6 percent slopes
40C	Coloma-Toogood complex, 6 to 12 percent slopes
40D	Coloma-Toogood complex, 12 to 18 percent slopes
41	Granby mucky loamy sand, gravelly substratum
42B	Spinks-Remus-Fern complex, 0 to 6 percent slopes
42C	Spinks-Remus-Fern complex, 6 to 12 percent slopes
42D	Spinks-Remus-Fern complex, 12 to 18 percent slopes
42E	Spinks-Remus-Fern complex, 18 to 35 percent slopes
43B	Spinks loamy fine sand, 0 to 6 percent slopes
43C	Spinks loamy fine sand, 6 to 12 percent slopes
43D	Spinks loamy fine sand, 12 to 18 percent slopes
43E	Spinks loamy fine sand, 18 to 35 percent slopes
44B	Thetford loamy fine sand, 0 to 4 percent slopes
45B	Spinks-Benona complex, 0 to 6 percent slopes
45C	Spinks-Benona complex, 6 to 12 percent slopes
45D	Spinks-Benona complex, 12 to 18 percent slopes
45E	Spinks-benona complex, 18 to 35 percent slopes
45F	Spinks-Benona complex, 35 to 70 percent slopes
46B	Grattan sand, dark subsoil, 0 to 6 percent slopes
48A	Saugatuck-Jebavy complex, 0 to 3 percent slopes
49B	Grattan sand, 0 to 6 percent slopes
49B3	Grattan sand, 0 to 6 percent slopes, severely eroded
49C	Grattan sand, 6 to 18 percent slopes
49C3	Grattan sand, 6 to 18 percent slopes, severely eroded
49E	Grattan sand, 18 to 35 percent slopes
49F	Grattan sand, 35 to 70 percent slopes
50B	Covert sand, 0 to 6 percent slopes
51B	Pipestone fine sand, 0 to 4 percent slopes
52	Granby sand
53B	Grattan sand, loamy substratum, 0 to 6 percent slopes
53	Grattan sand, loamy substratum, 6 to 12 percent slopes
56B	Benona sand, deep banded, 0 to 6 percent slopes
56C	Benona sand, deep banded, 6 to 18 percent slopes
56E	Benona sand, deep banded, 18 to 35 percent slopes
57C	Nordhouse fine sand, 3 to 18 percent slopes
57F	Nordhouse fine sand, 18 to 75 percent slopes
58	Kingsville mucky sand
59B	Benona sand, 0 to 6 percent slopes
59C	Benona sand, 6 to 18 percent slopes
59E	Benona sand, 18 to 35 percent slopes
60B	Coloma sand, 0 to 6 percent slopes
60C	Coloma sand, 6 to 18 percent slopes
60E	Coloma sand, 18 to 35 percent slopes
61B	Epworth fine sand, 0 to 6 percent slopes
61C	Epworth fine sand, 6 to 18 percent slopes
61E	Epworth fine sand, 18 to 35 percent slopes
62B	Plainfield sand, 0 to 6 percent slopes
62C	Plainfield sand, 6 to 18 percent slopes

SYMBOL	NAME
65	Sloan silt loam, frequently flooded
67	Cohoctah fine sandy loam, occasionally flooded
69	Algansee loamy fine sand, occasionally flooded
70	Glendora mucky loamy fine sand, frequently flooded
71	Houghton and Carlisle soils
72	Adrian muck
73	Palms muck
75	Martisco muck
77	Napoleon muck
83	Histosols and Aquents, ponded
84F	Dune land-Quartzipsamments-Psammaquents complex, nearly level to steep
85F	Udorthents-Quartzipsamments complex, very steep
86F	Dune land-Quartzipsamments complex, rolling to very steep
87	Beaches
88A	Udipsamments, nearly level
89A	Udorthents, nearly level
91	Pits, sand and gravel
92B	Chelsea fine sand, 0 to 6 percent slopes
92C	Chelsea fine sand, 6 to 12 percent slopes
96B	Spinks-Tekenink loamy fine sands, 0 to 6 percent slopes
96C	Spinks-Tekenink loamy fine sands, 6 to 12 percent slopes
96D	Spinks-Tekenink loamy fine sands, 12 to 18 percent slopes
96E	Spinks-Tekenink loamy fine sands, 18 to 35 percent slopes
97	Kerston and Carlisle mucks, frequently flooded
98B	Spinks-Scalley complex, 0 to 6 percent slopes
98C	Spinks-Scalley complex, 6 to 12 percent slopes
98D	Spinks-Scalley complex, 12 to 18 percent slopes
99B	Nappanee-Hoytville silt loams, 0 to 4 percent slopes
100B	Nappanee silt loam, 0 to 4 percent slopes
101B	Claybanks silt loam, 1 to 6 percent slopes
101C	Claybanks silt loam, 6 to 12 percent slopes
210B	Typic Udipsamments, nearly level and undulating
210C	Typic Udipsamments, rolling
210D	Typic Udipsamments, hilly
211B	Typic Udipsamments, banded substratum, nearly level and undulating
211C	Typic Udipsamments, banded substratum, rolling
212B	Typic Udipsamments, very deep water table, nearly level and undulating
213B	Argic Udipsamments, nearly level and undulating
213C	Argic Udipsamments, rolling
213D	Argic Udipsamments, hilly
220B	Entic Haplorthods, sandy, nearly level and undulating
220C	Entic Haplorthods, sandy, rolling
220D	Entic Haplorthods, sandy, hilly
220E	Entic Haplorthods, sandy, steep and very steep
221B	Entic Haplorthods, sandy, coarse-loamy banded substratum, nearly level and undulating
221C	Entic Haplorthods, sandy, coarse-loamy banded substratum, rolling
221D	Entic Haplorthods, sandy, coarse-loamy banded substratum, hilly
221E	Entic Haplorthods, sandy, coarse-loamy banded substratum, steep and very steep
222B	Entic Haplorthods, sandy, very deep water table, nearly level and undulating
222C	Entic Haplorthods, sandy, very deep water table, rolling
223B	Entic Haplorthods, sandy, fine-loamy banded substratum, nearly level and undulating
223C	Entic Haplorthods, sandy, fine-loamy banded substratum, rolling
223D	Entic Haplorthods, sandy, fine-loamy banded substratum, hilly
223E	Entic Haplorthods, sandy, fine-loamy banded substratum, steep and very steep
224B	Entic Haplorthods, sandy, deep water table, nearly level and undulating
225B	Entic Haplorthods, sandy, loamy substratum, nearly level and undulating
225C	Entic Haplorthods, sandy, loamy substratum, rolling
225D	Entic Haplorthods, sandy, loamy substratum, hilly
230B	Entic Haplorthods, sandy, calcareous substratum, nearly level and undulating
230C	Entic Haplorthods, sandy, calcareous substratum, rolling
230D	Entic Haplorthods, sandy, calcareous substratum, hilly
230E	Entic Haplorthods, sandy, calcareous substratum, steep and very steep
231B	Entic Haplorthods, sandy-Alfic Haplorthods, sandy over loamy complex, nearly level and undulating
233B	Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, nearly level and undulating
233C	Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, rolling
233D	Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, hilly
233E	Alfic Haplorthods, sandy over loamy-Entic Haplorthods, sandy complex, steep and very steep
235B	Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, nearly level and undulating
235C	Alfic Haplorthods, sandy over loamy-Alfic Haplorthods, sandy complex, rolling
240C	Entic Haplorthods, sandy, dark subsoil, rolling
241B	Entic Haplorthods, sandy, dark subsoil, banded substratum, nearly level and undulating
245B	Entic Haplorthods, sandy, dark subsoil, loamy substratum, nearly level and undulating
245C	Entic Haplorthods, sandy, dark subsoil, loamy substratum, rolling
245D	Entic Haplorthods, sandy, dark subsoil, loamy substratum, hilly
250	Mollic Psammaquents-Aquic Udipsamments-Medisaprists, euic complex, occasionally flooded
262A	Aeric Haplaquods, sandy, ortstein, nearly level
263A	Aquic Udipsamments, nearly level
272	Typic Haplaquods, sandy
273	Mollic Psammaquents
274	Typic Haplaquolls, sandy over loamy
280	Aquents and Histosols, ponded
281	Medisaprists, dysic
282	Medisaprists, euic

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND



CULTURAL FEATURES

BOUNDARIES
National, state, or province
County or parish
Minor civil division
Reservation (national forest or park, state forest or park, and large airport)
Land grant
Limit of soil survey (label)
Field sheet matchline and neatline
AD HOC BOUNDARY (label)
Small airport, airfield, park, oilfield, cemetery, Cut and Fill
STATE COORDINATE TICK
1 890 000 FEET
LAND DIVISION CORNER (sections and land grants)
ROADS
Divided (median shown if scale permits)
Other roads
Trail
ROAD EMBLEM & DESIGNATIONS
Interstate
Federal
State
Other
RAILROAD
POWER TRANSMISSION LINE (normally not shown)
PIPE LINE (normally not shown)
FENCE (normally not shown)
LEVEES
Without road
With road
With railroad
DAMS
Large (to scale)
Medium or Small (Named where applicable)
PITS
Gravel pit
Mine or quarry

MISCELLANEOUS CULTURAL FEATURES
Farmstead, house (omit in urban area) (occupied)
Church
School
Indian mound (label)
Located object (label)
Tank (label)
Wells, oil or gas
Windmill
Kitchen midden

WATER FEATURES

DRAINAGE
Perennial, double line
Perennial, single line
Intermittent
Drainage end
Canals or ditches
Double-line (label)
Drainage and/or irrigation
LAKES, PONDS AND RESERVOIRS
Perennial
Intermittent
MISCELLANEOUS WATER FEATURES
Marsh or swamp
Spring
Well, artesian
Well, irrigation
Wet spot

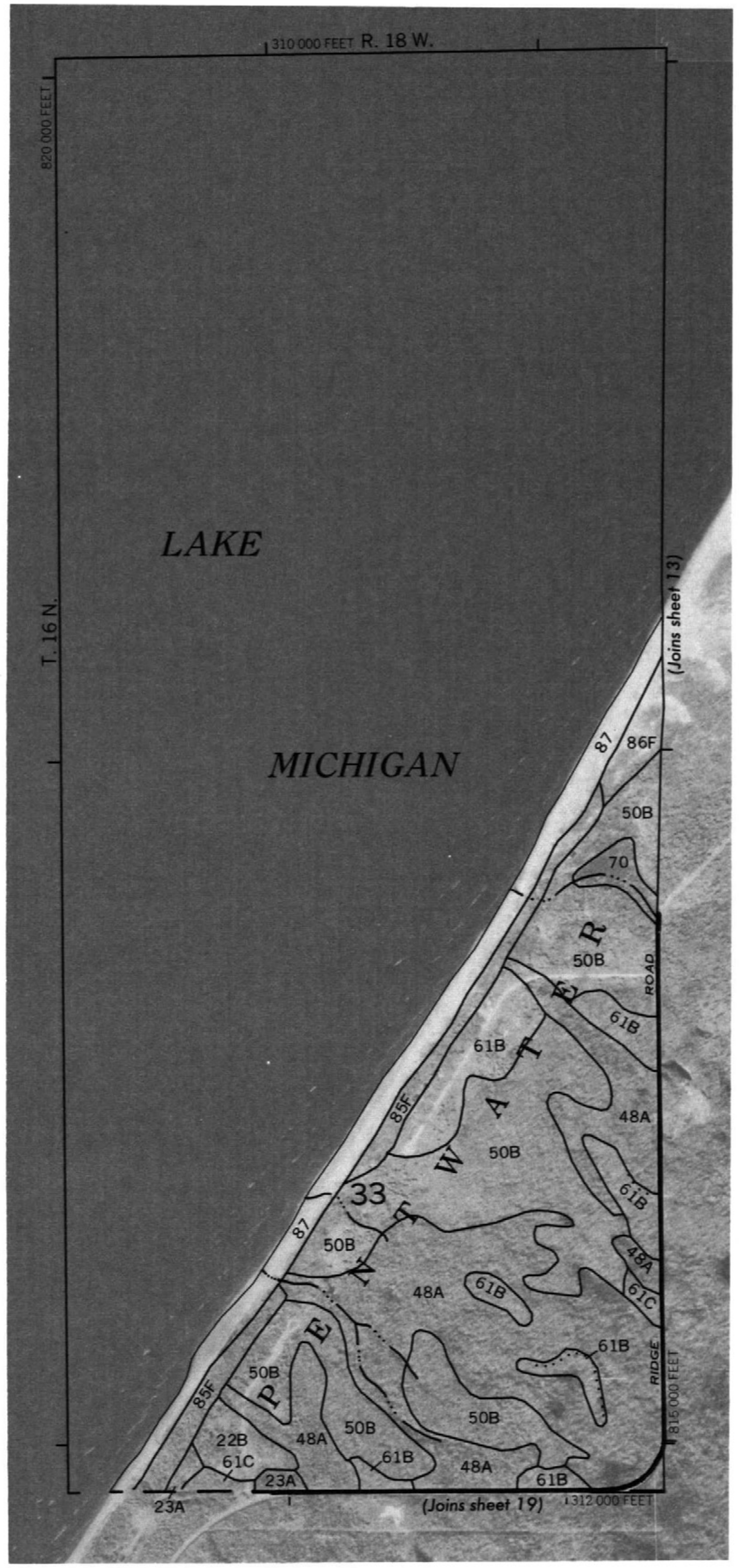
SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS
ESCARPMENTS
Bedrock (points down slope)
Other than bedrock (points down slope)
SHORT STEEP SLOPE
GULLY
DEPRESSION OR SINK
SOIL SAMPLE (normally not shown)
MISCELLANEOUS
Blowout
Clay spot
Gravelly spot
Gumbo, slick or scabby spot (sodic)
Dumps and other similar non soil areas
Prominent hill or peak
Rock outcrop (includes sandstone and shale)
Saline spot
Sandy spot
Severely eroded spot
Slide or slip (tips point upslope)
Stony spot, very stony spot
Mineral in organic < 3 ac.
Borrow pit < 3 ac.
Loamy spot < 3 ac.
Organic in mineral < 3 ac.

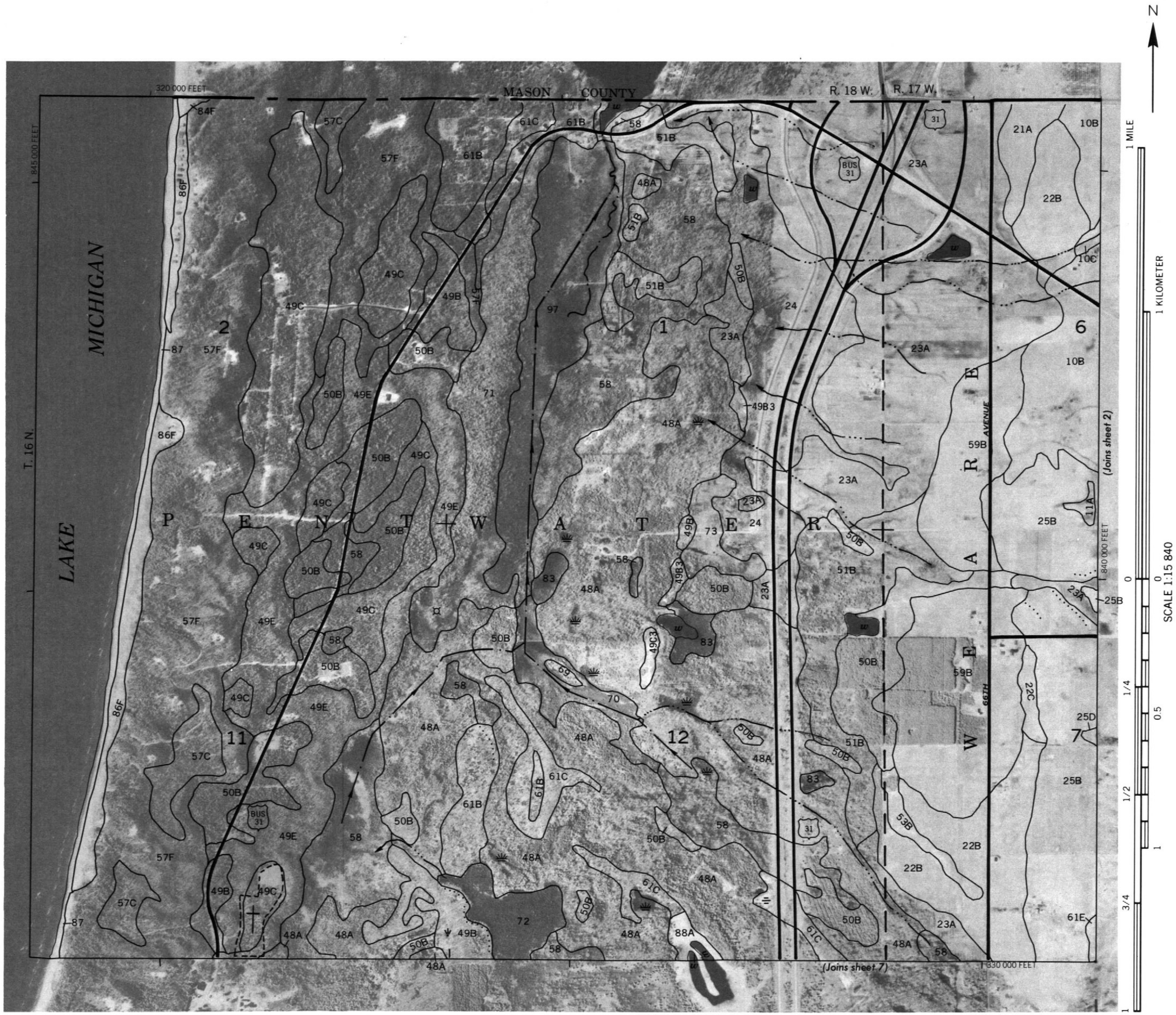
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 1

①

OCEANA COUNTY, MICHIGAN NO. 1

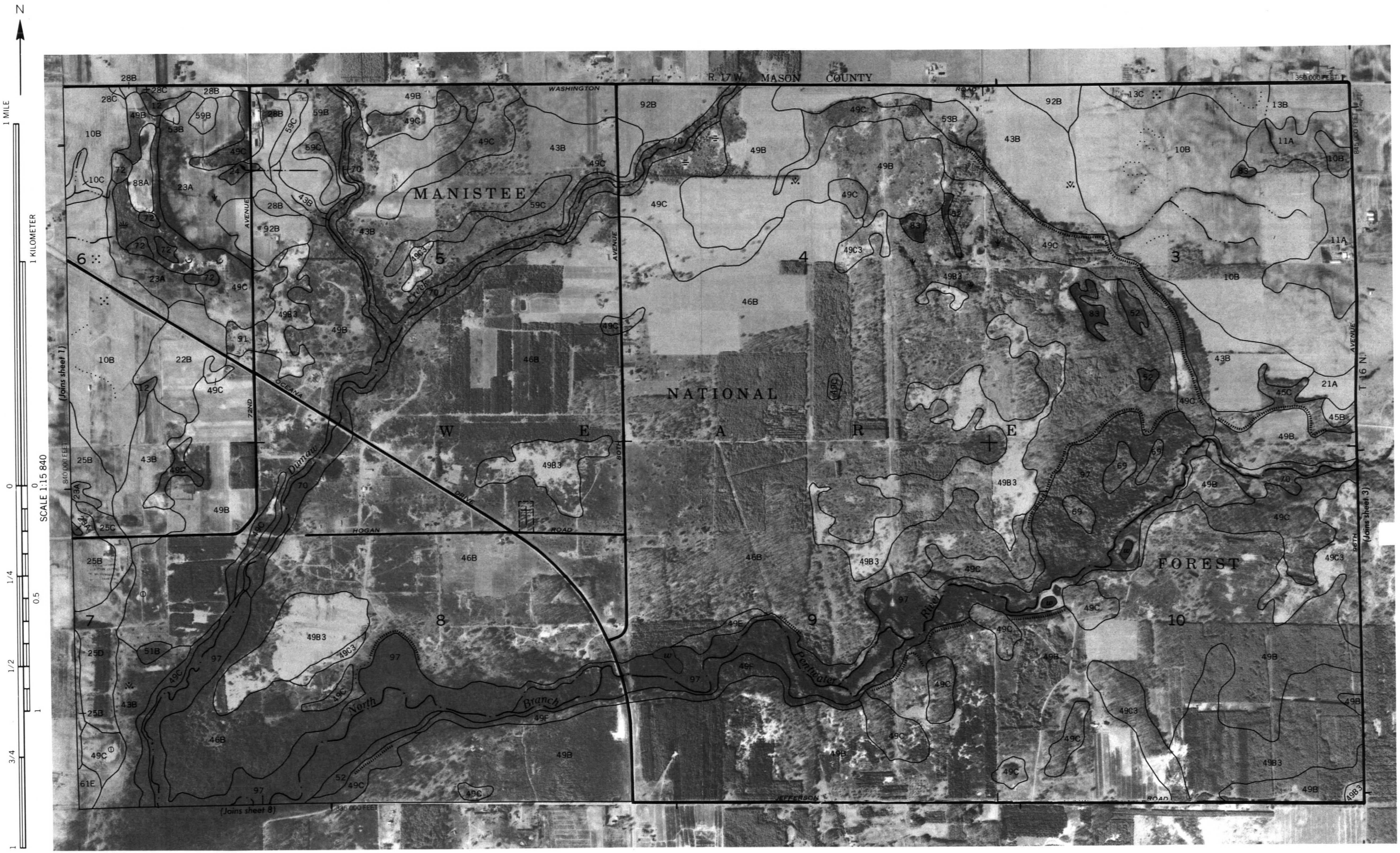


2000 AND 5000-FOOT GRID TICKS



②

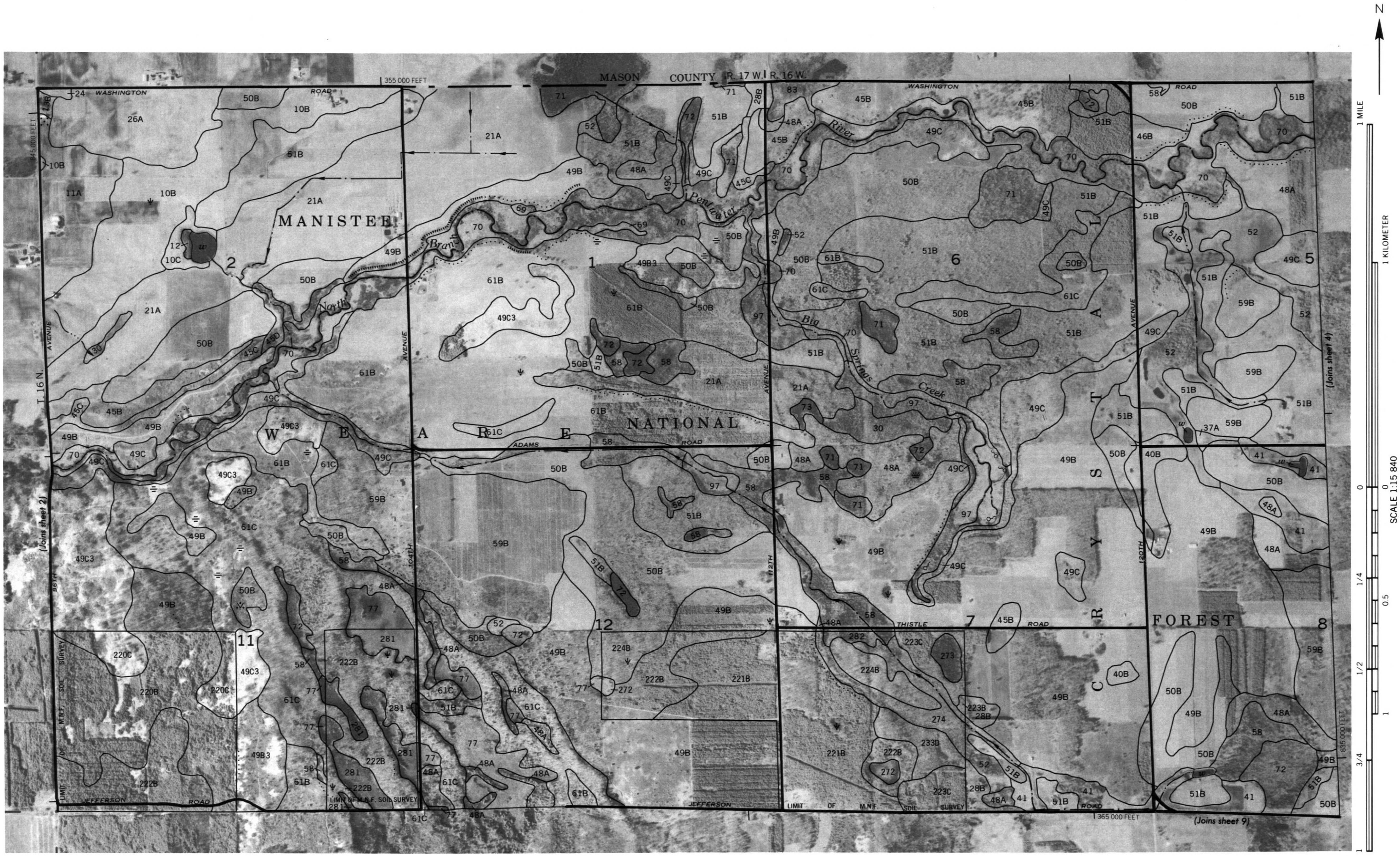
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 2



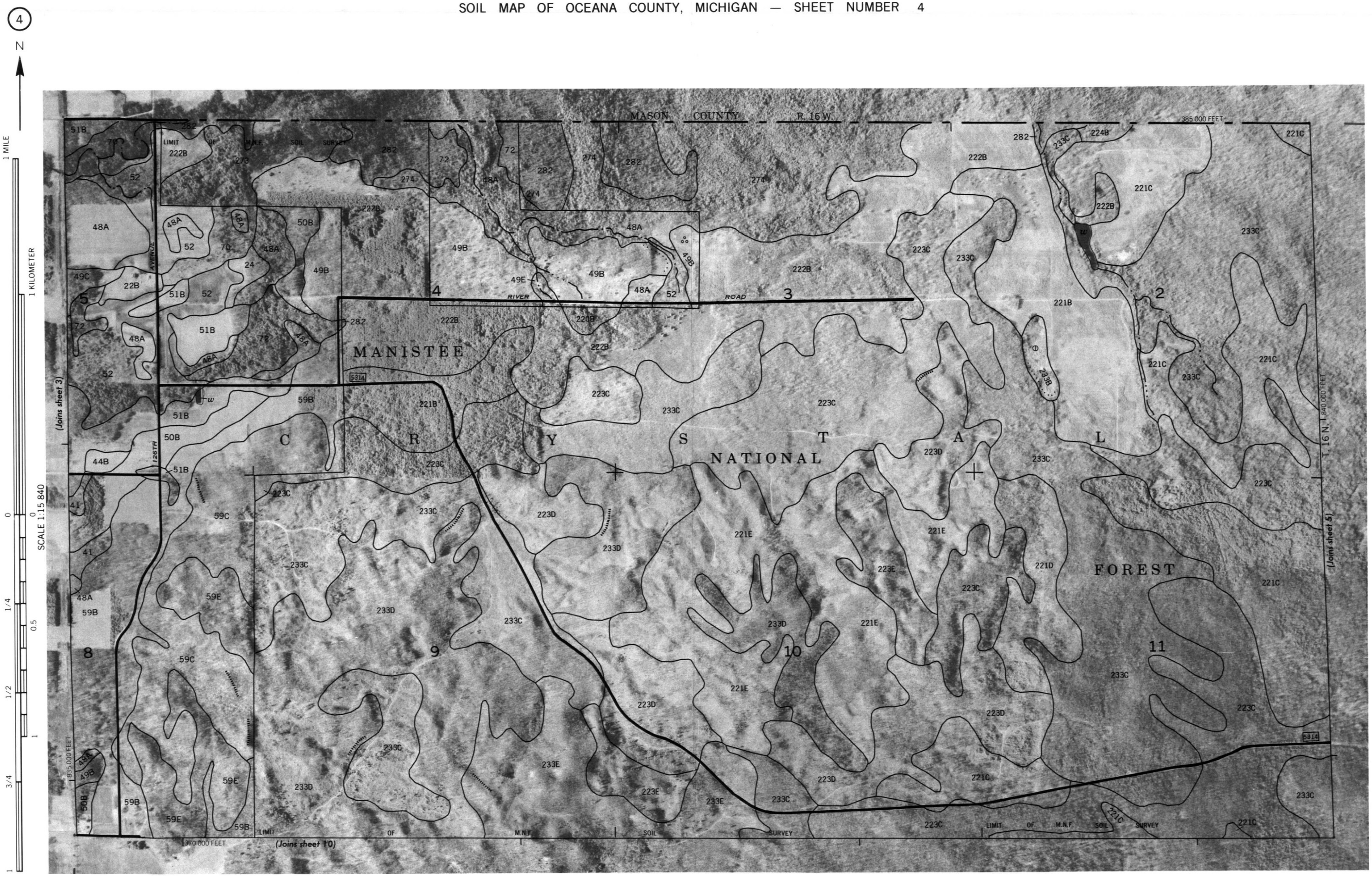
OCEANA COUNTY, MICHIGAN NO. 2

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 3

OCEANA COUNTY, MICHIGAN NO. 3

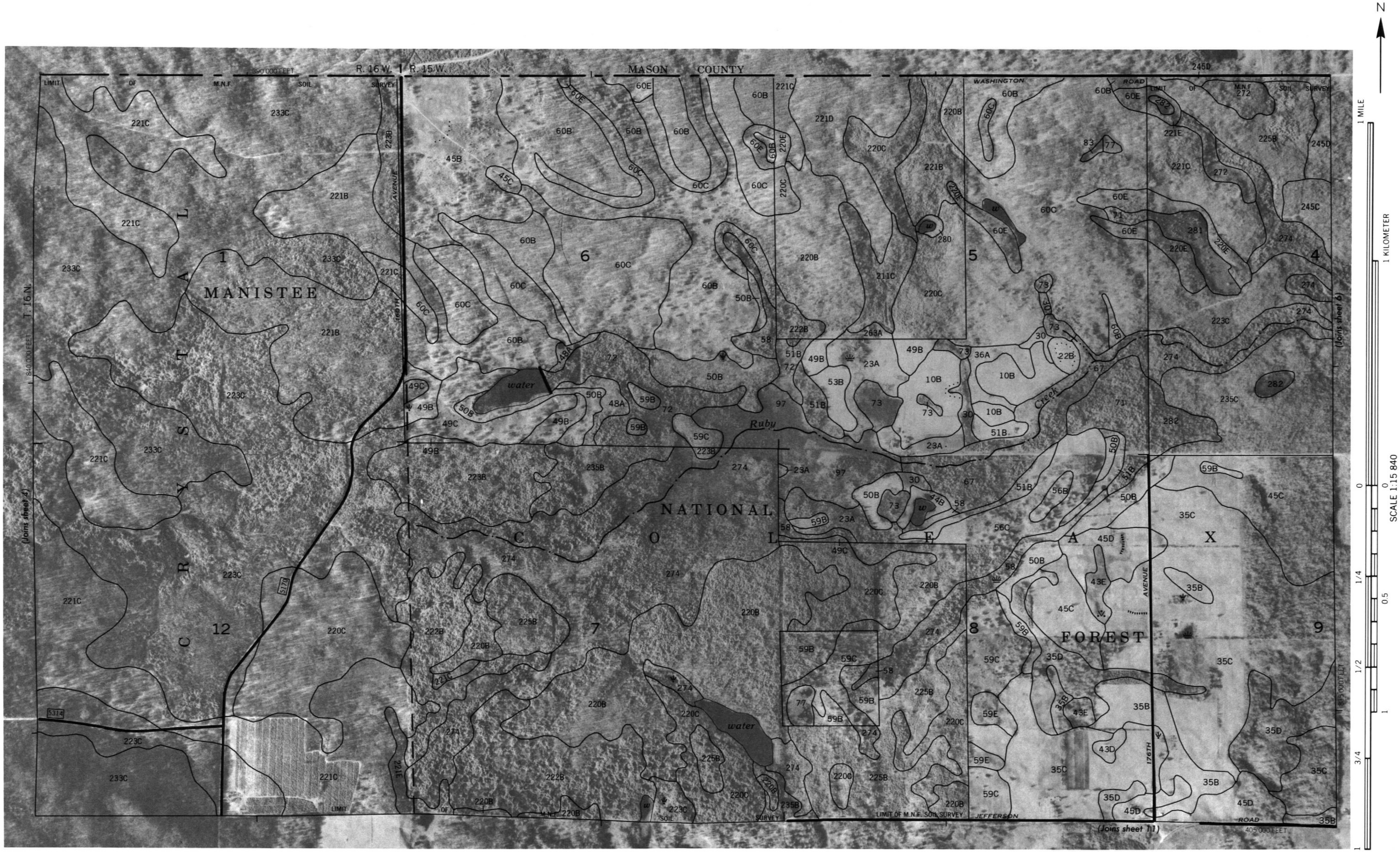


SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 4



OCEANA COUNTY, MICHIGAN NO. 4

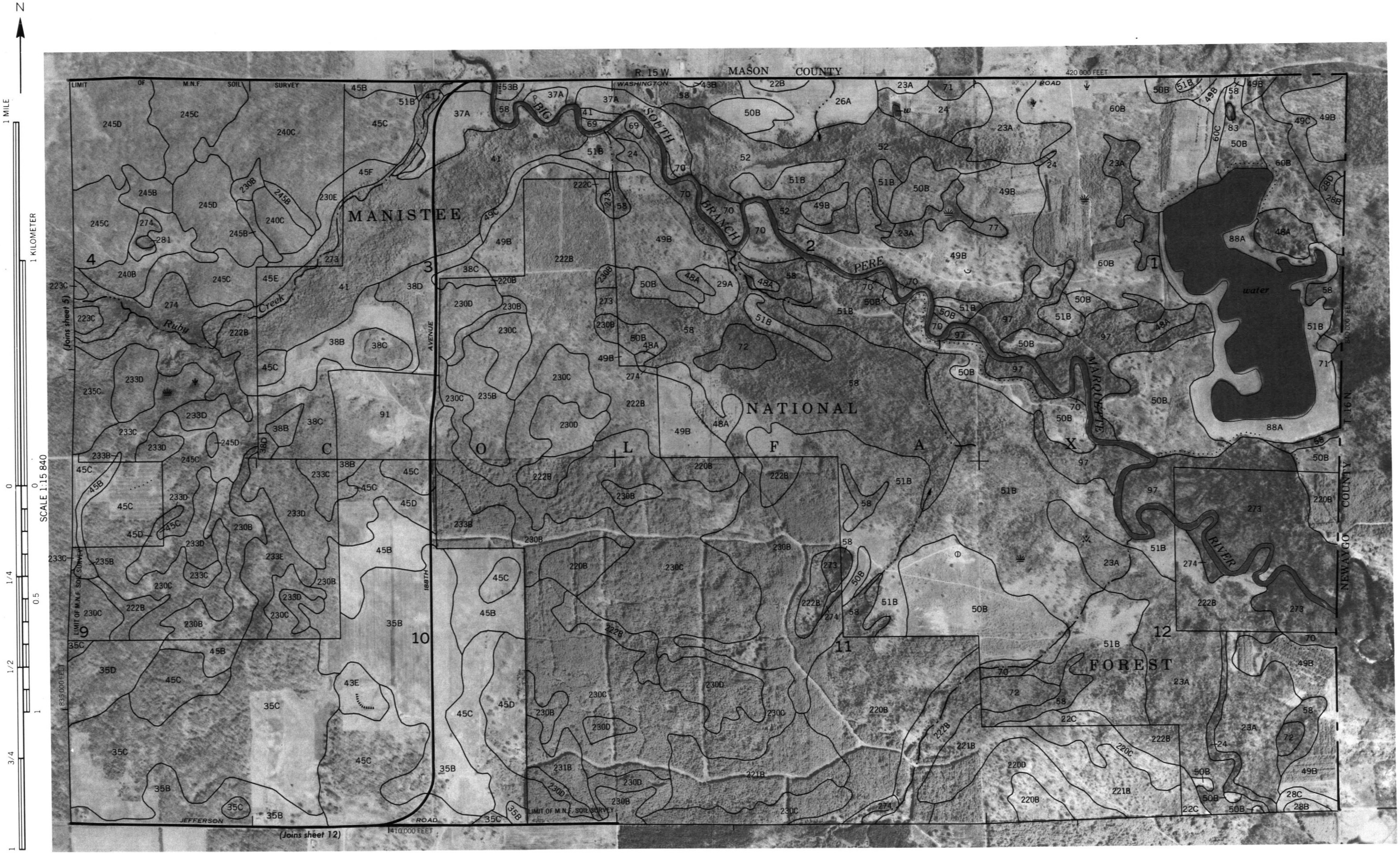
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 5



OCEANA COUNTY, MICHIGAN NO. 5

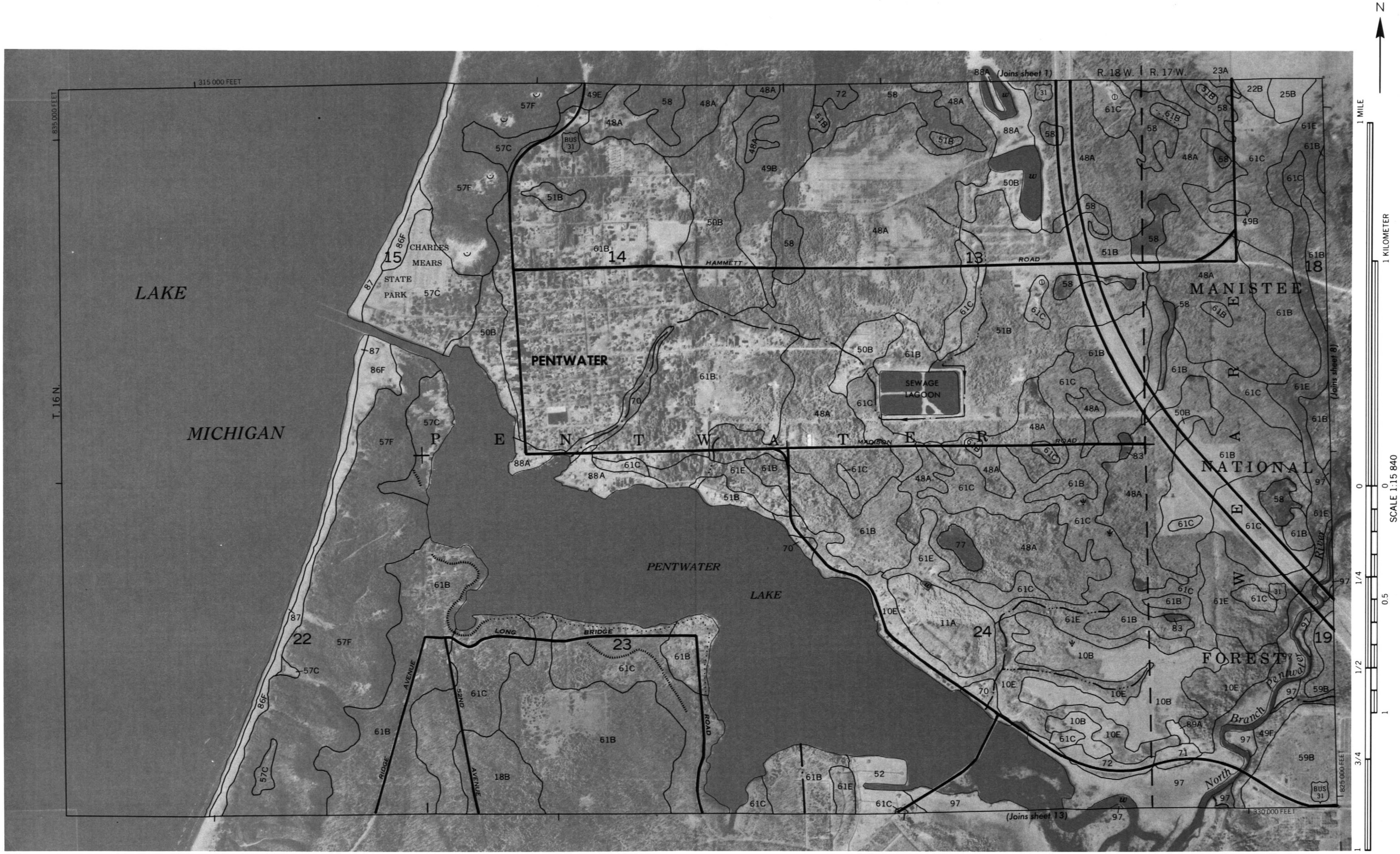
⑥

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 6

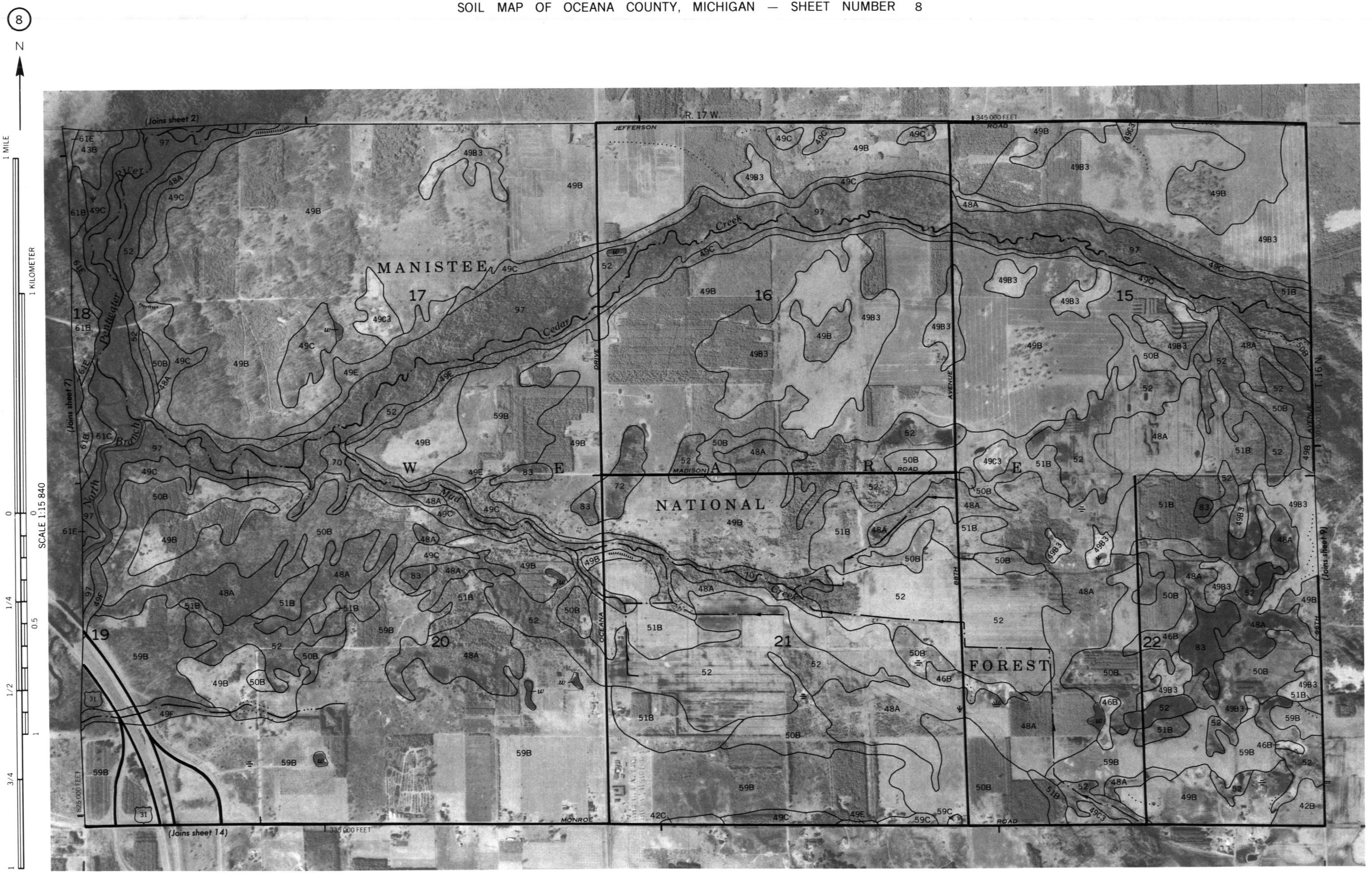


OCEANA COUNTY, MICHIGAN NO. 6

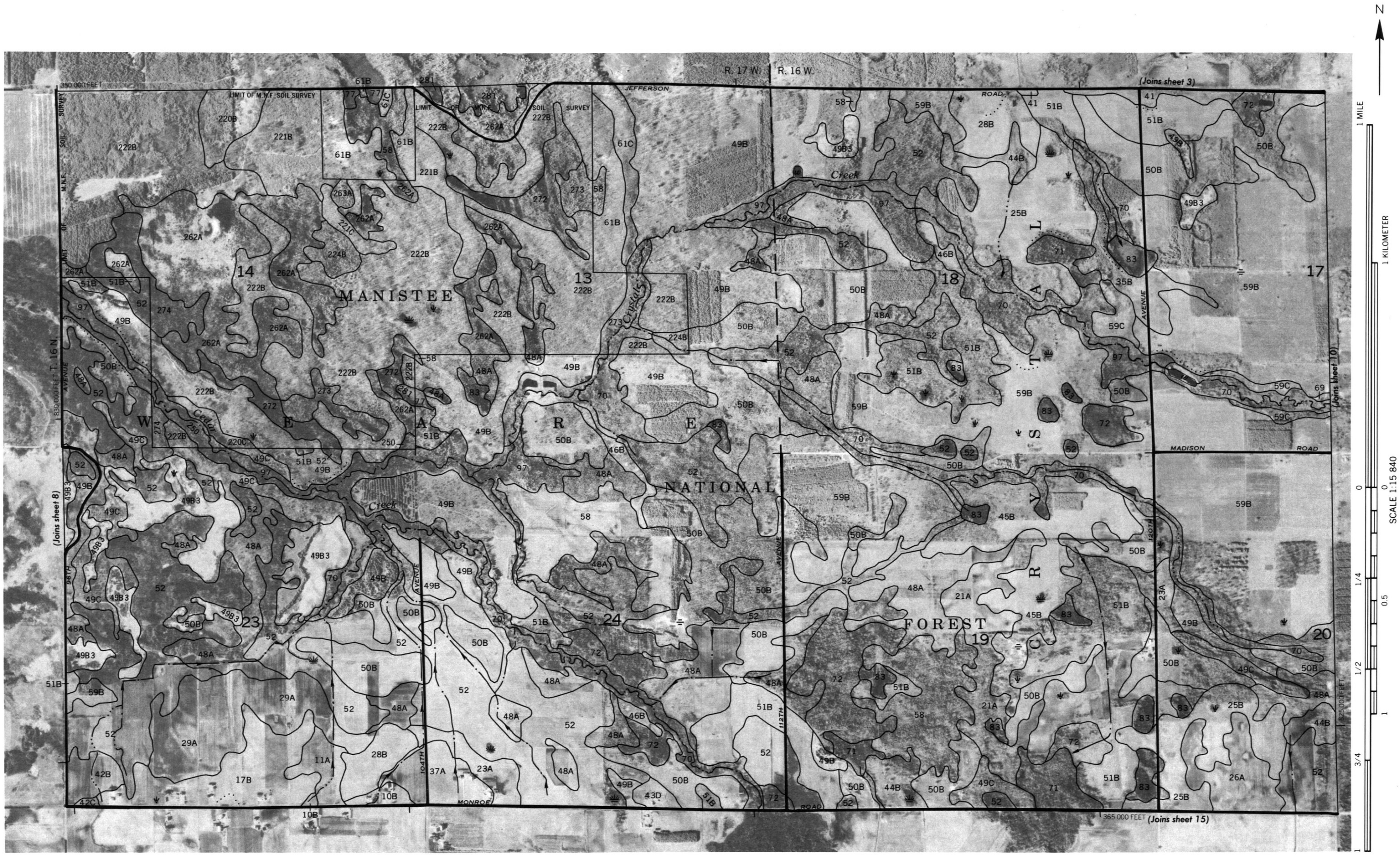
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 7



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 8



OCEANA COUNTY, MICHIGAN NO. 8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365 000 FEET
1 825 000 FEET
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(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 15)
LIMIT OF M.N.F. SOIL SURVEY
LIMIT OF M.N.F. SOIL SURVEY
LIMIT OF M.N.F. SOIL SURVEY
JEFFERSON ROAD
MADISON ROAD
MONROE ROAD
98TH AVENUE
104TH AVENUE
112TH AVENUE
120TH AVENUE
AVENUE
Crystal Creek
Cedar Creek
MANISTEE NATIONAL FOREST
WEAR
CRYSTAL
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14
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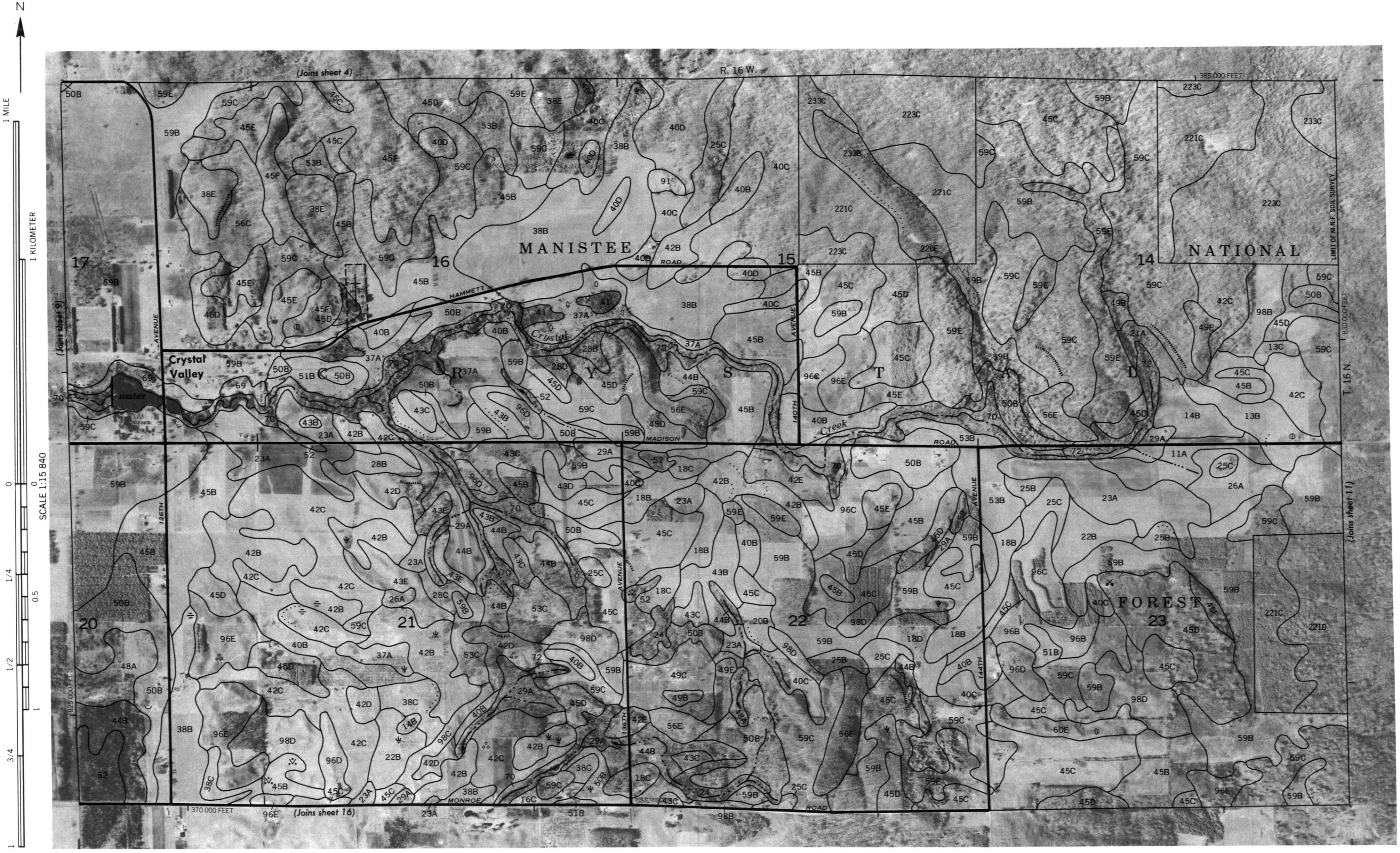
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 10



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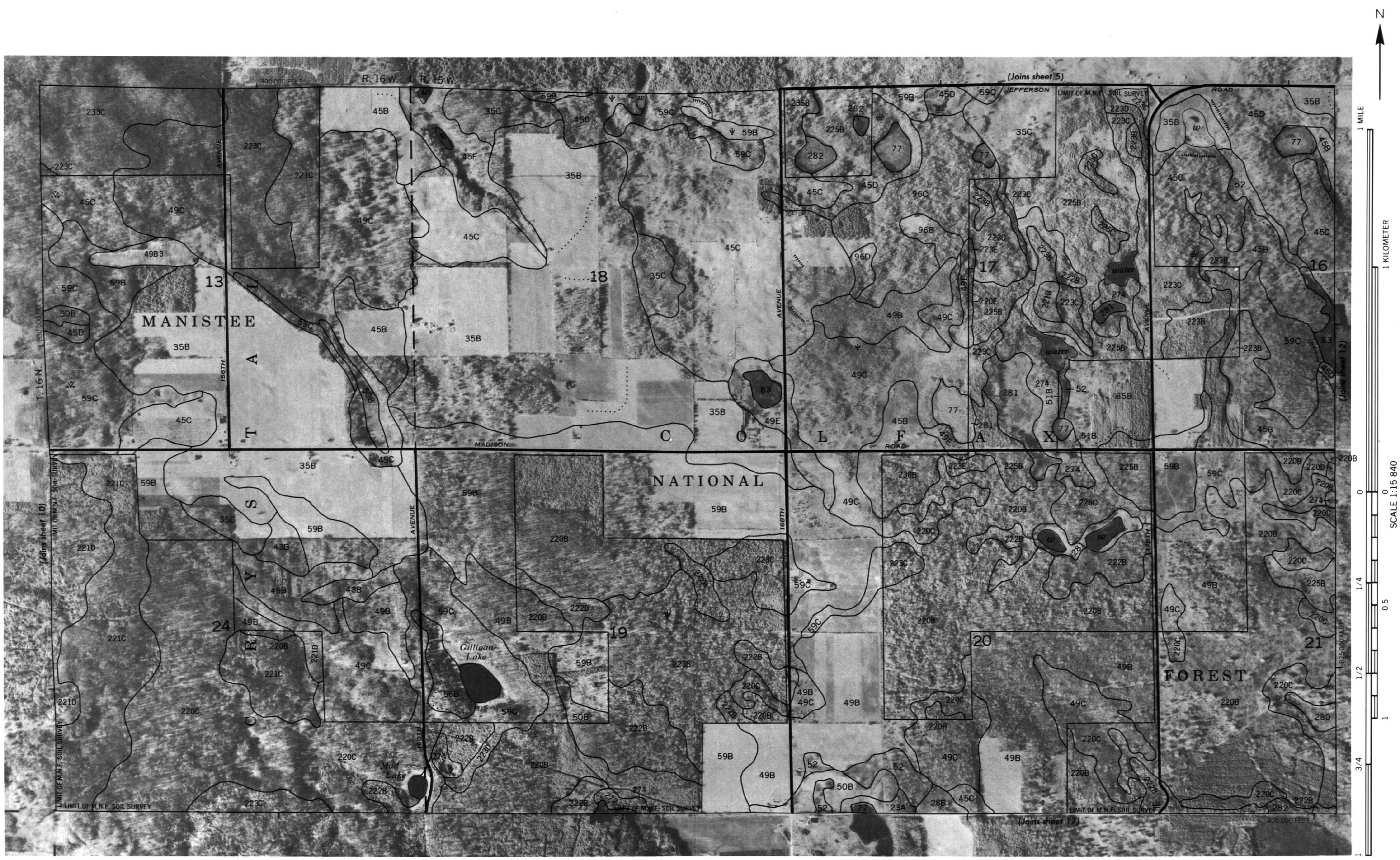
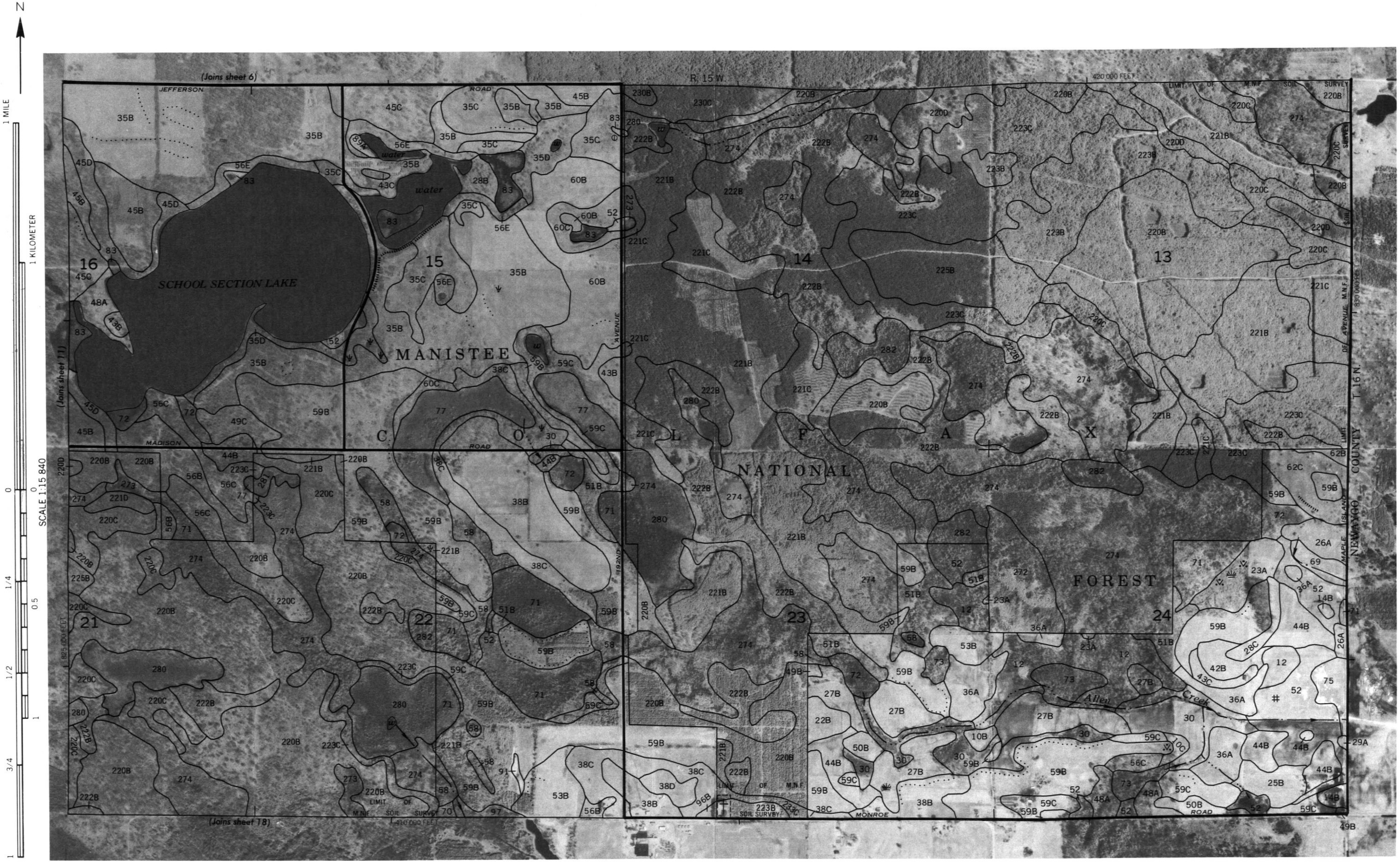


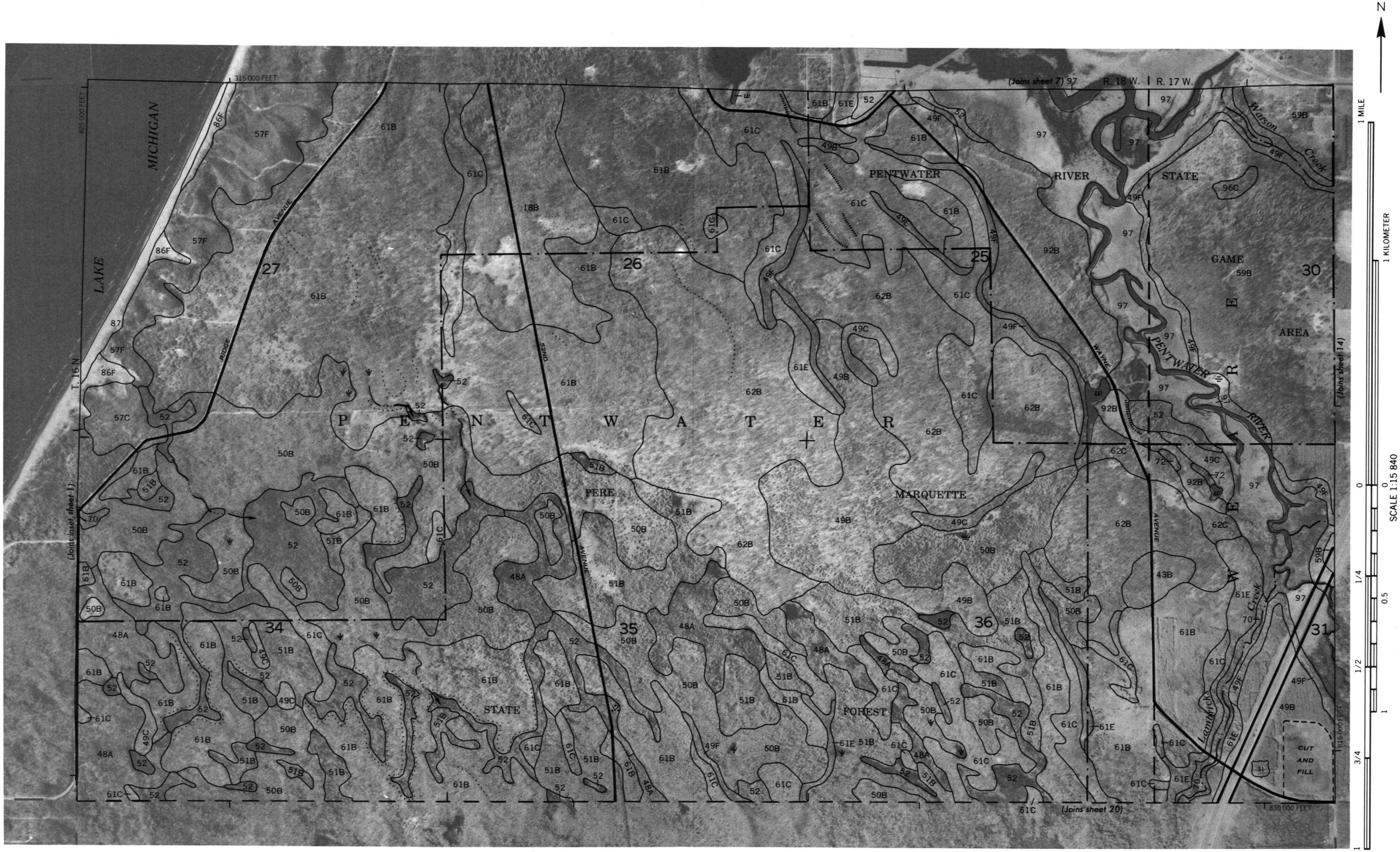
OCEANA COUNTY, MICHIGAN NO. 11

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 12



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 13

OCEANA COUNTY, MICHIGAN NO. 13



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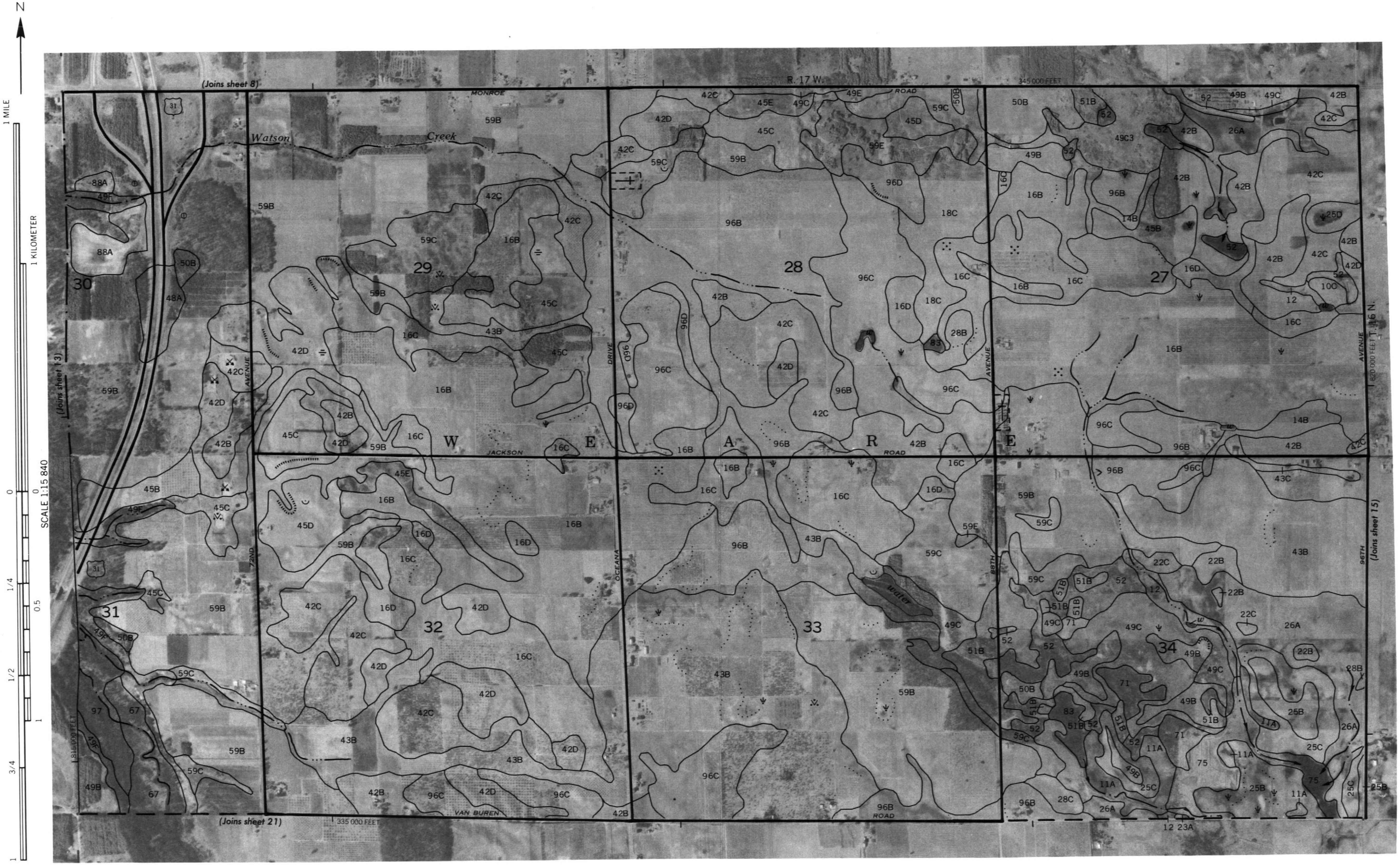
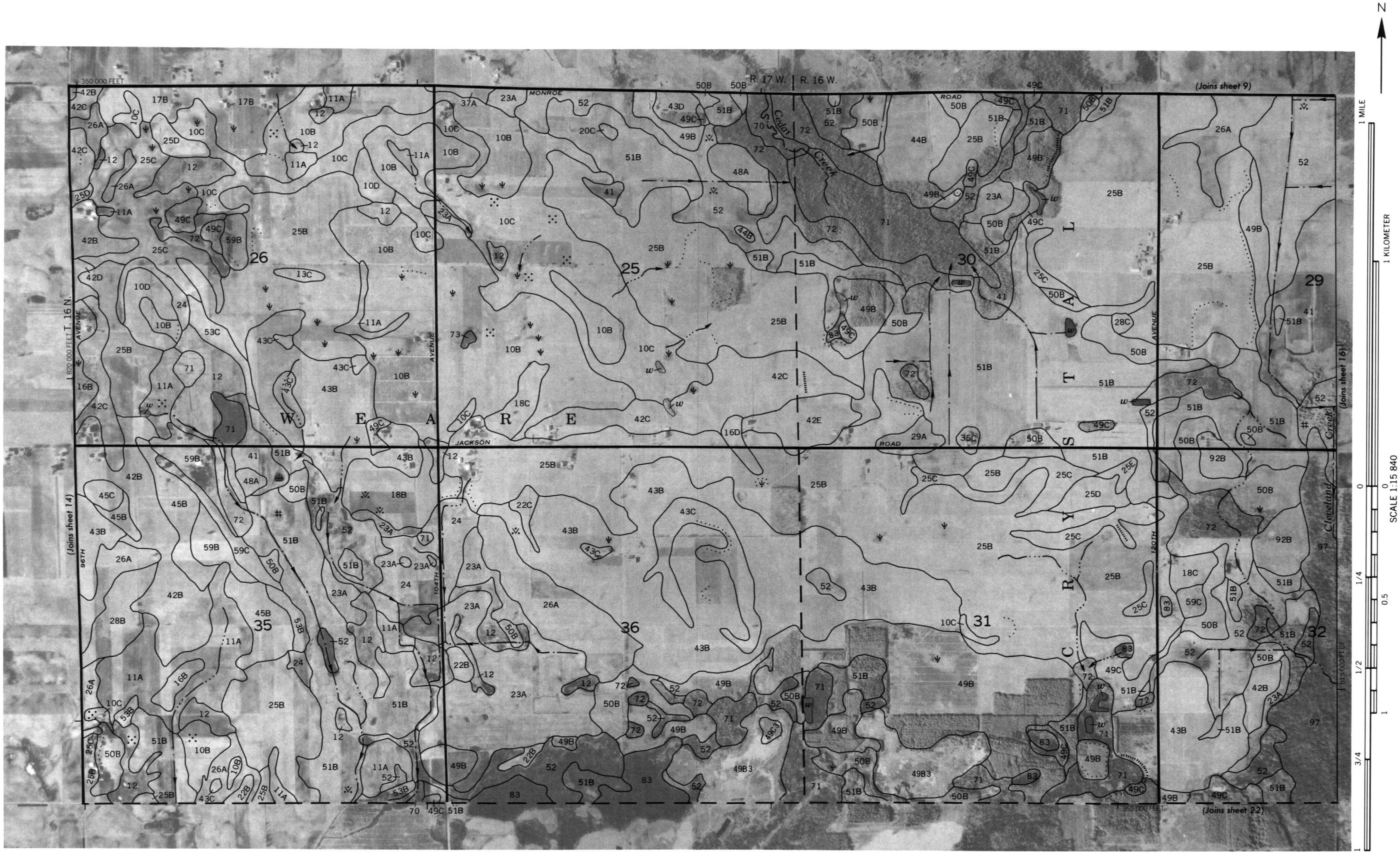


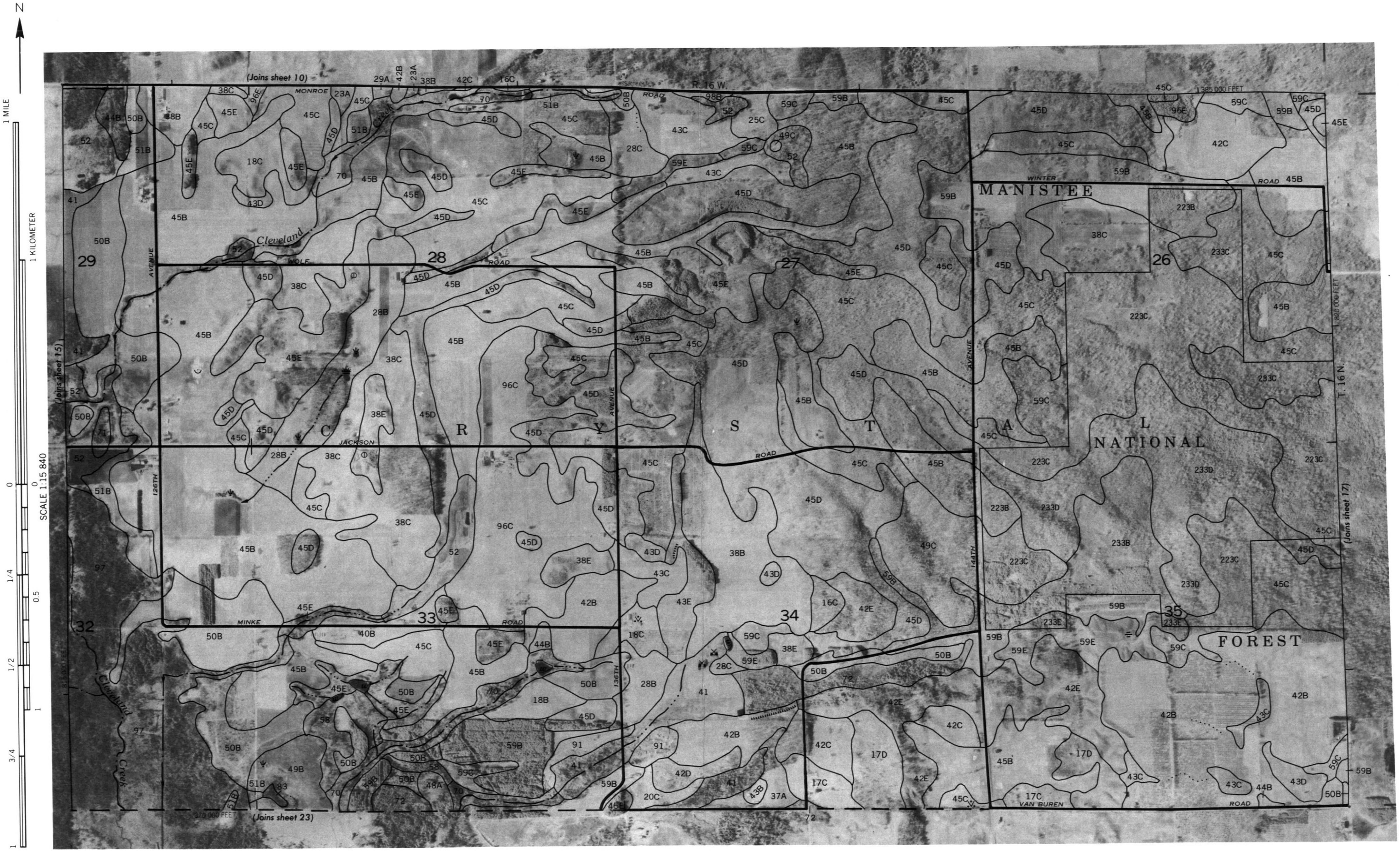
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 15



CEANA COUNTY, MICHIGAN NO. 15

16

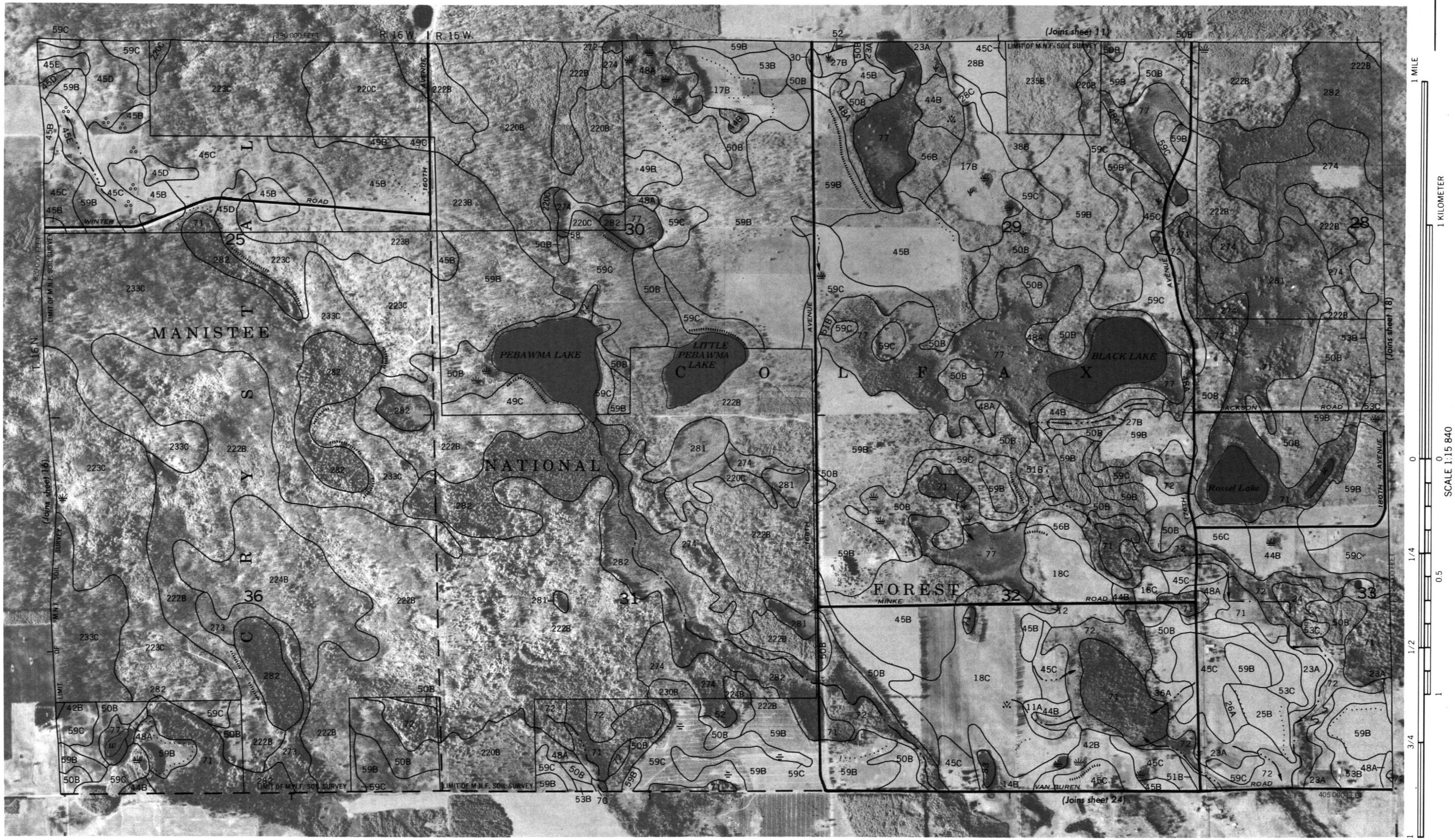
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 16



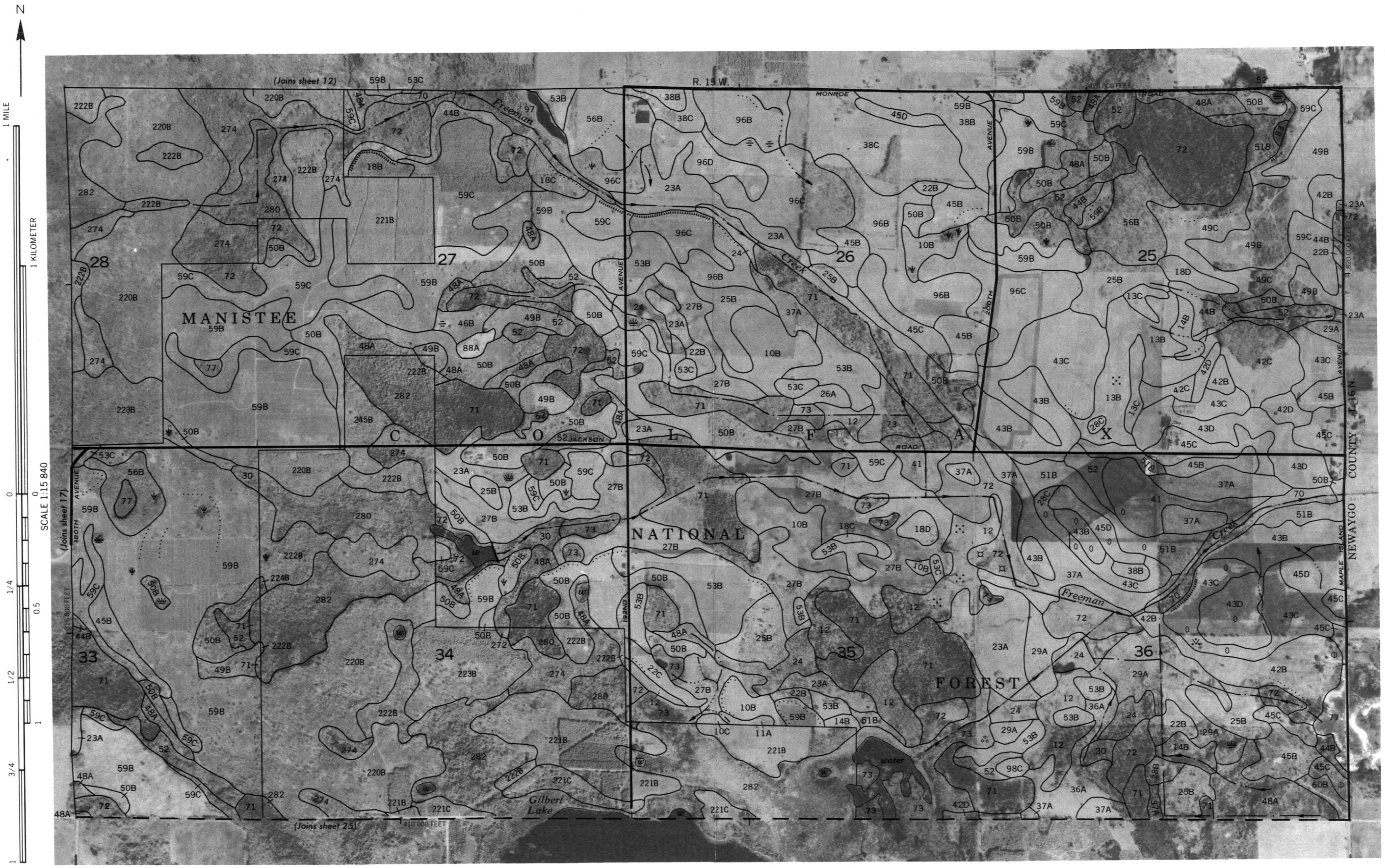
OCEANA COUNTY, MICHIGAN NO. 16

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 17

OCEANA COUNTY, MICHIGAN NO. 17



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 18



OCEANA COUNTY, MICHIGAN NO. 18

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 19

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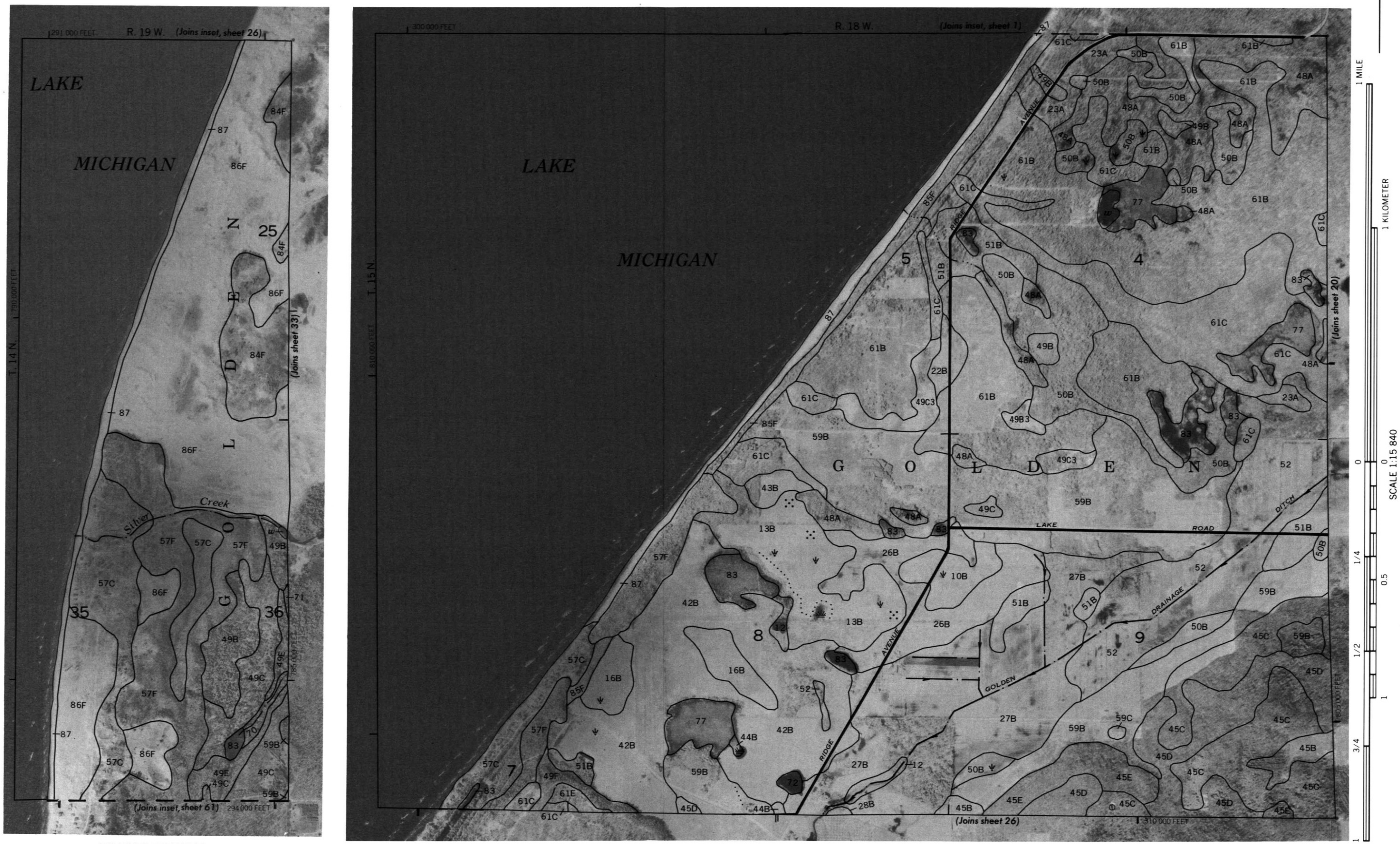
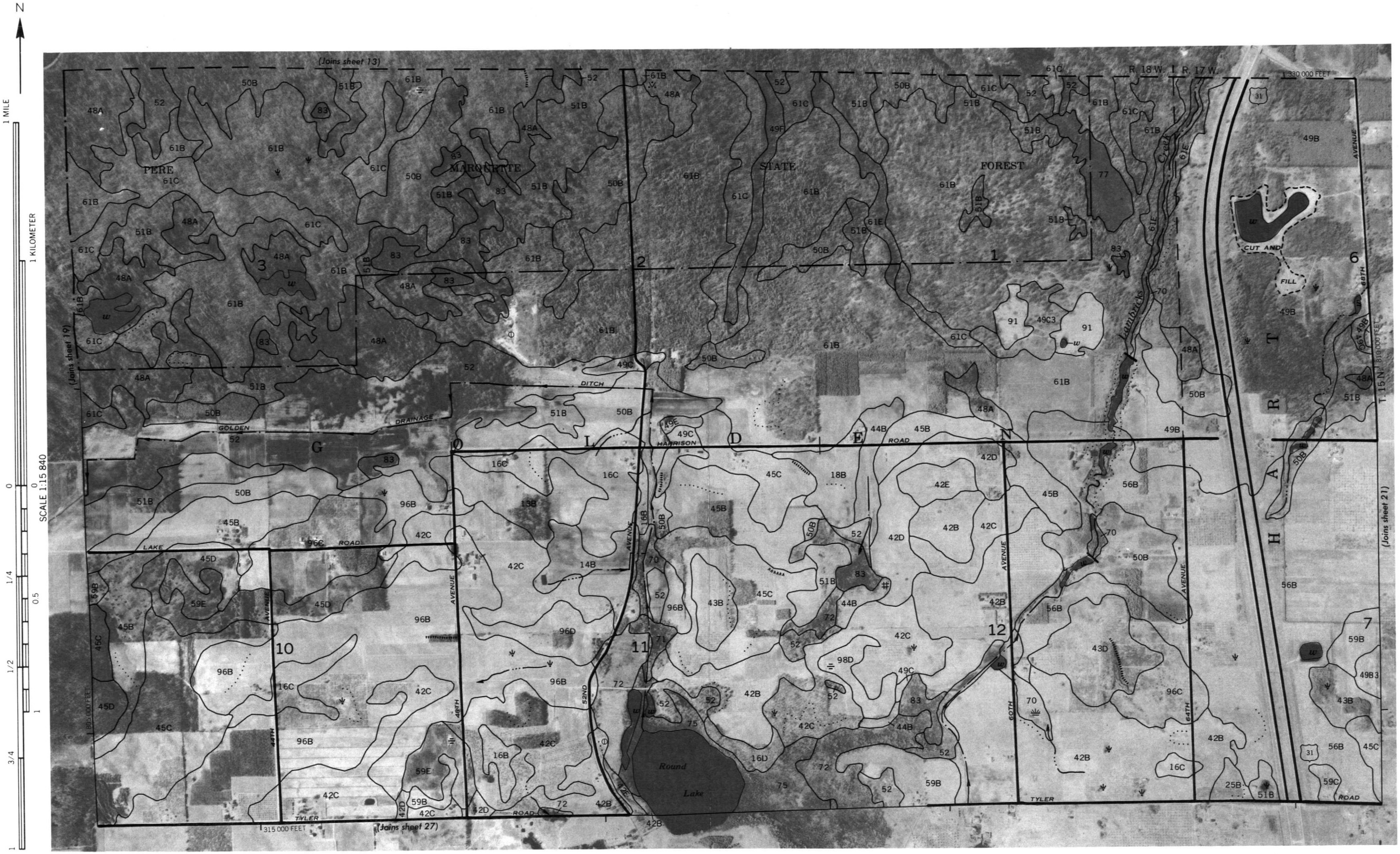
OCEANA COUNTY, MICHIGAN NO. 19



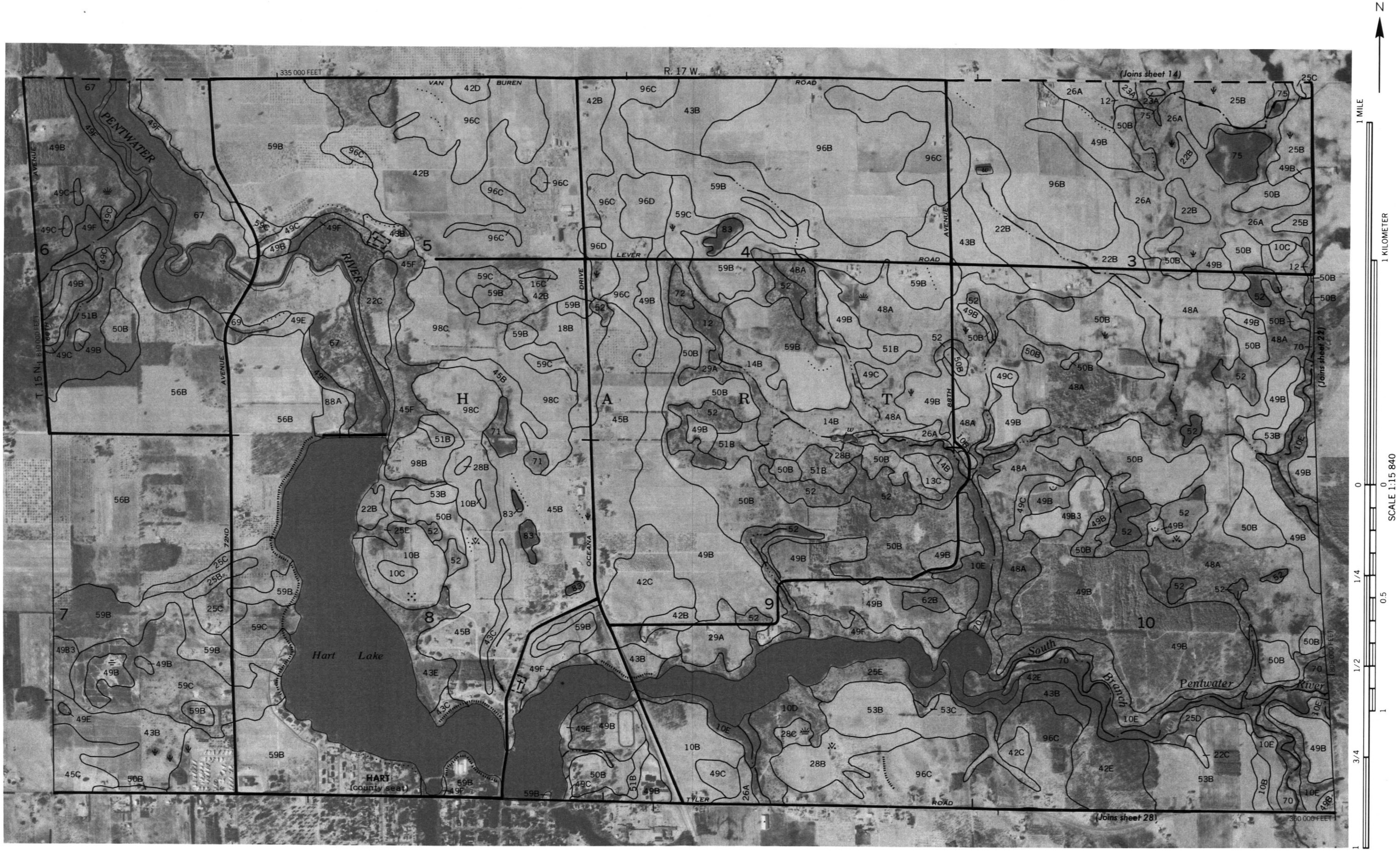
3000 AND 5000-FOOT GRID TICKS

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 20



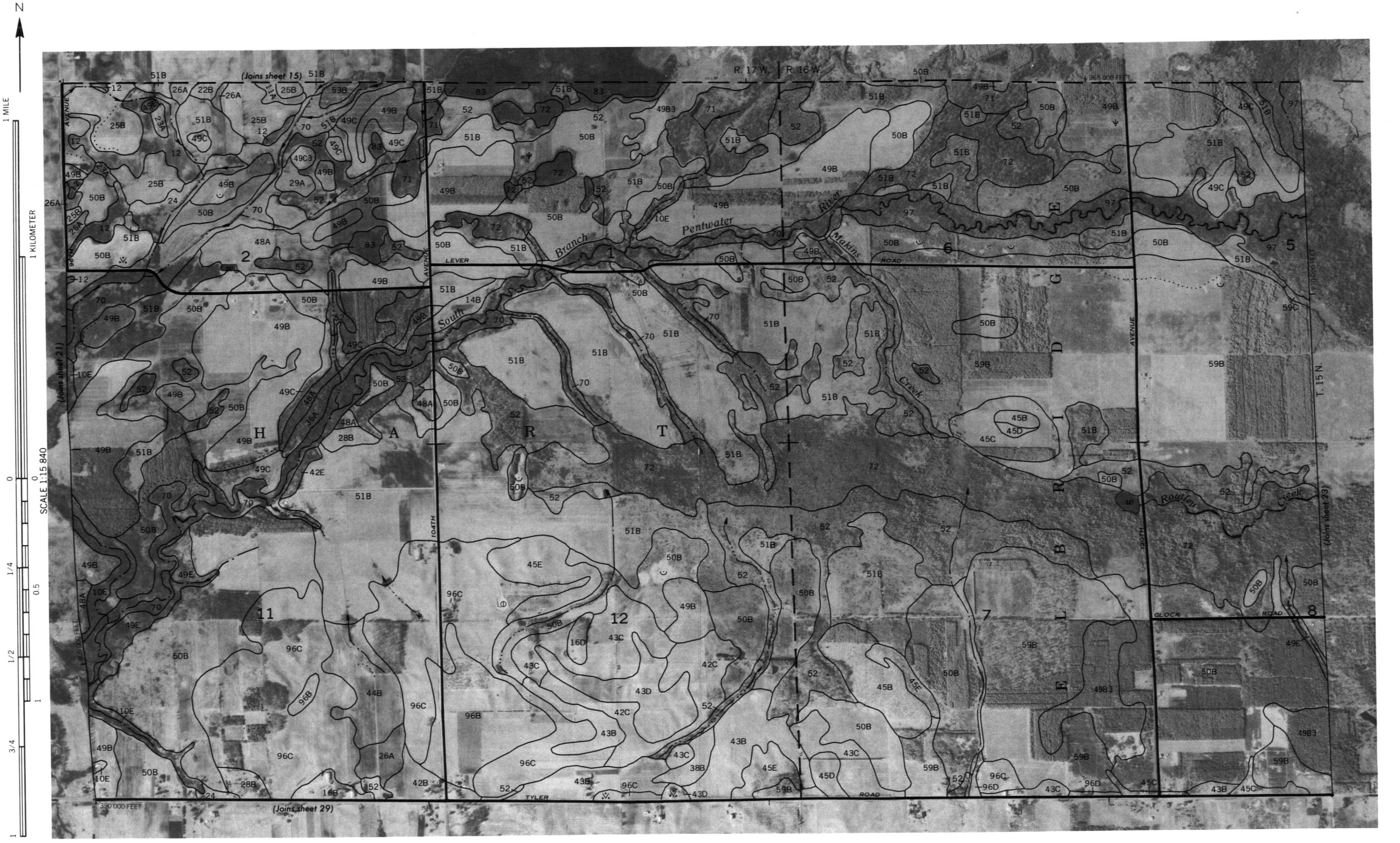
OCEANA COUNTY, MICHIGAN NO. 20

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 21



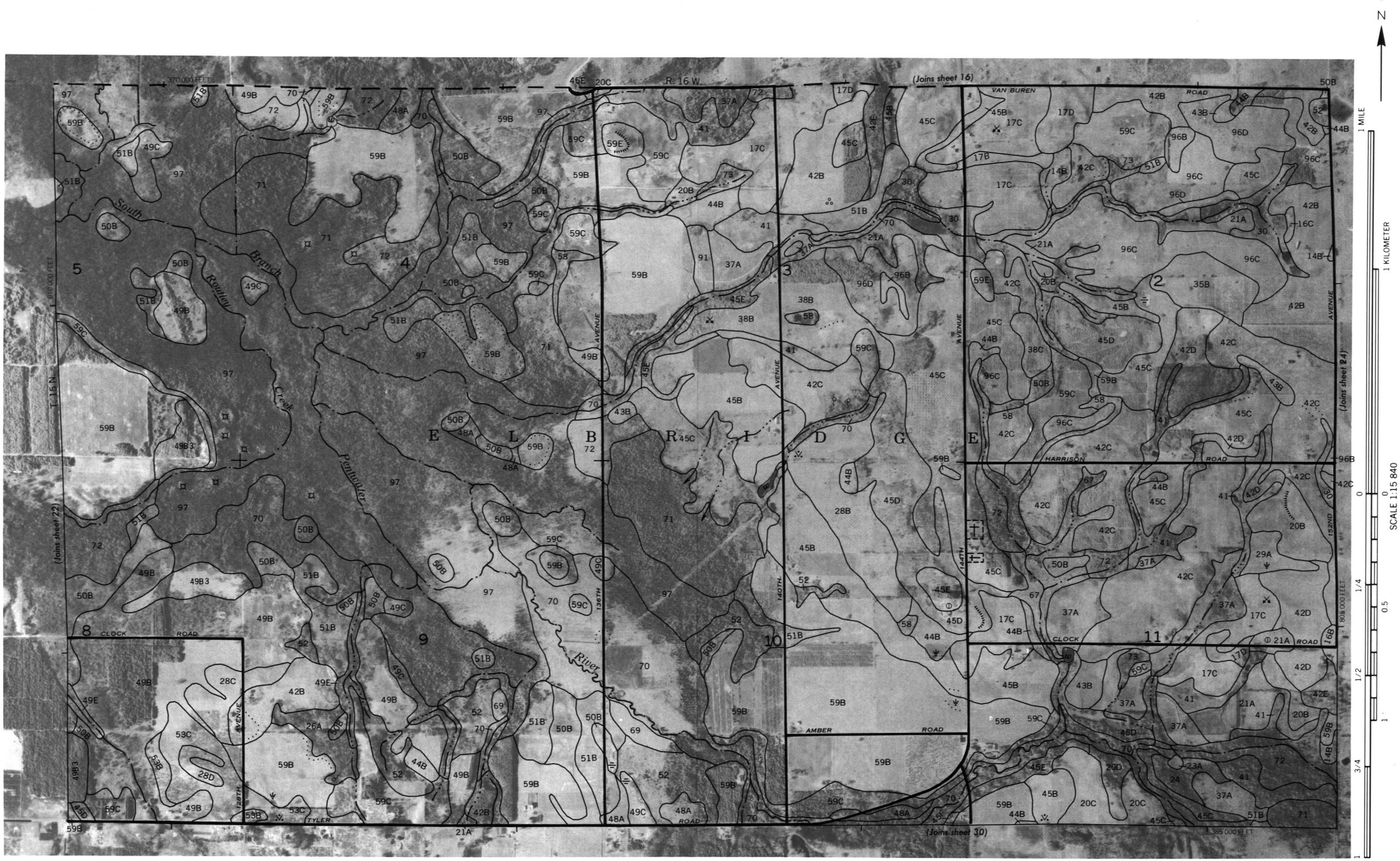
OCEANA COUNTY, MICHIGAN NO. 21

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 22

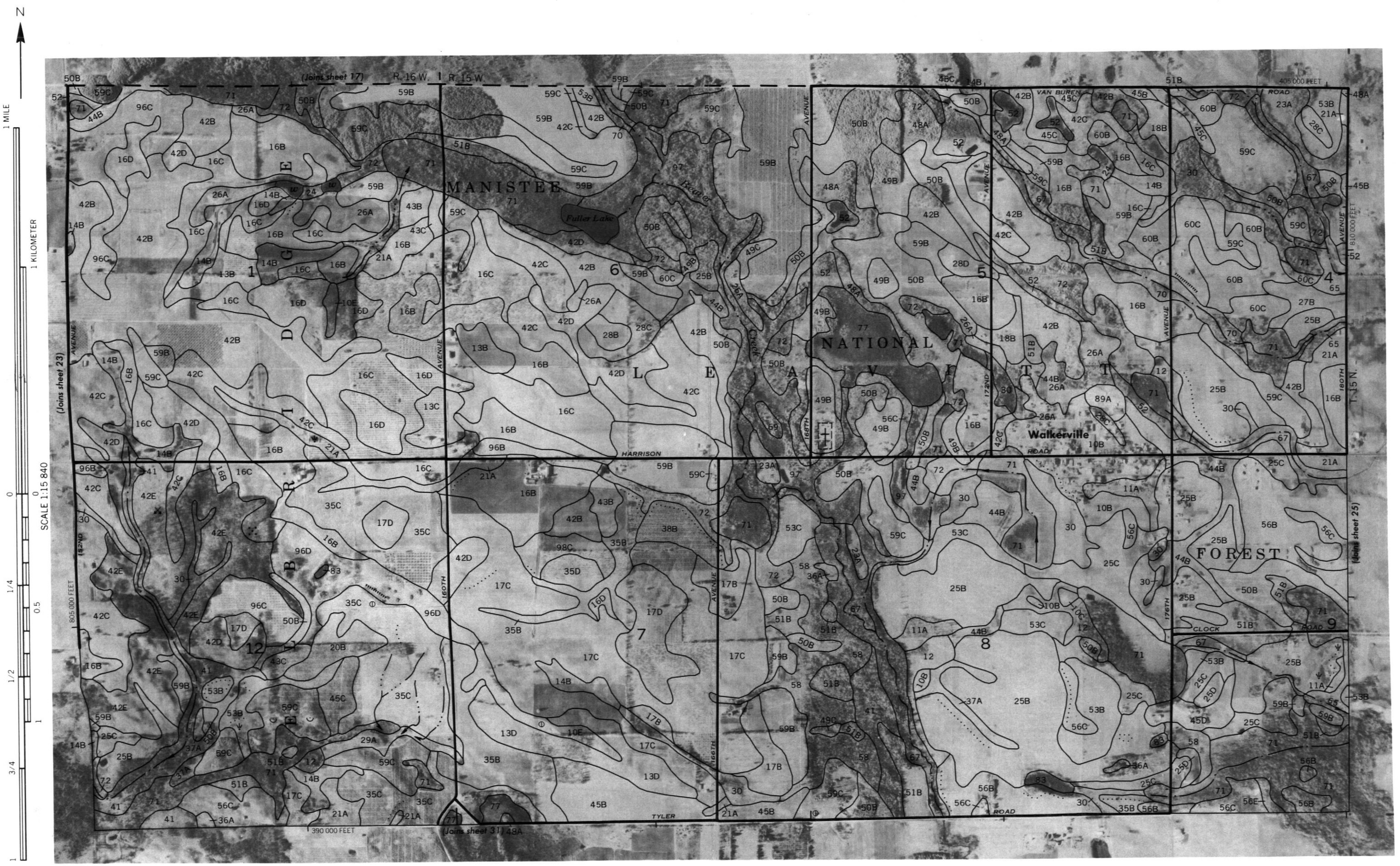


SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 23

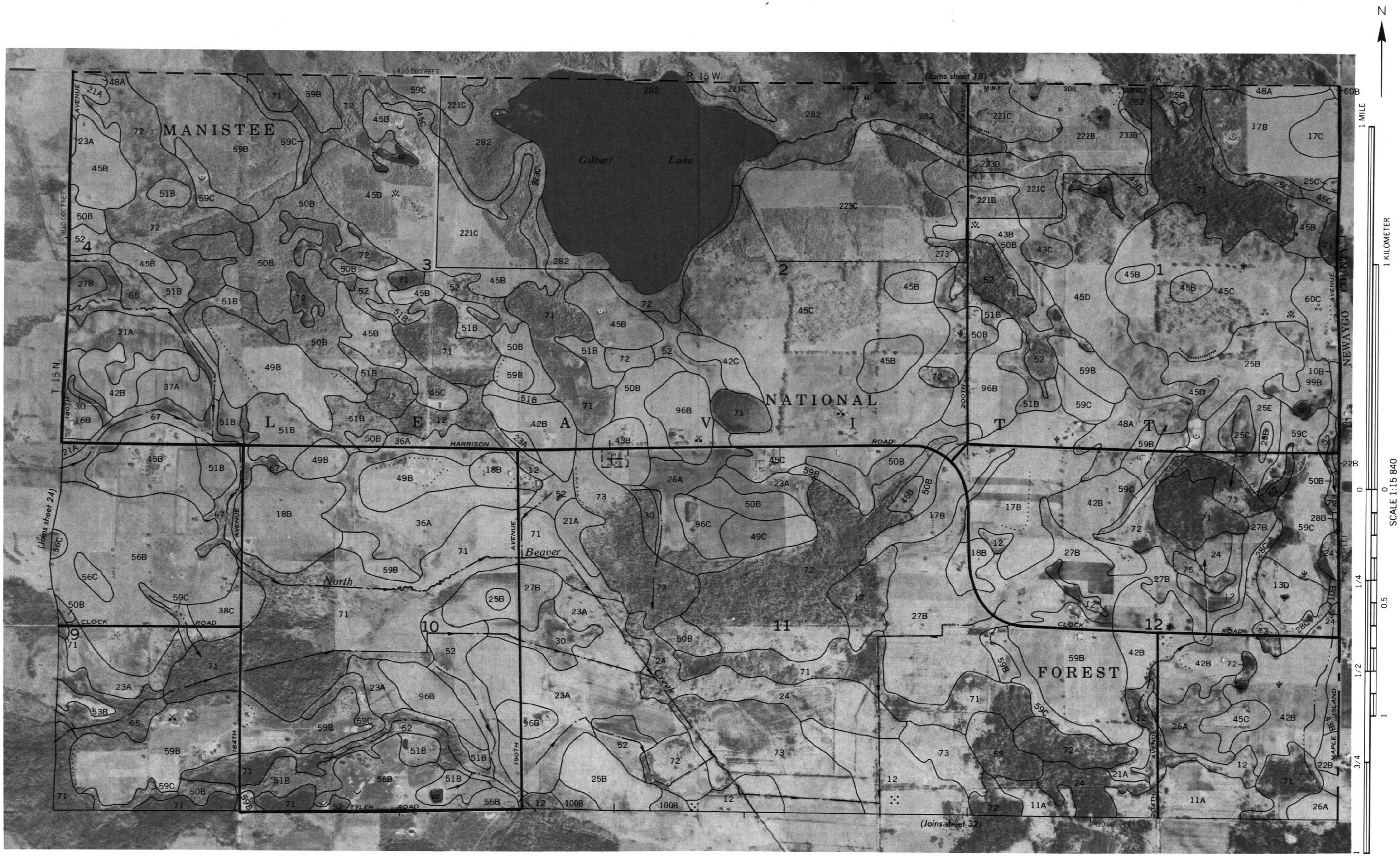
OCEANA COUNTY, MICHIGAN NO. 23



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 24



OCEANA COUNTY, MICHIGAN NO. 25



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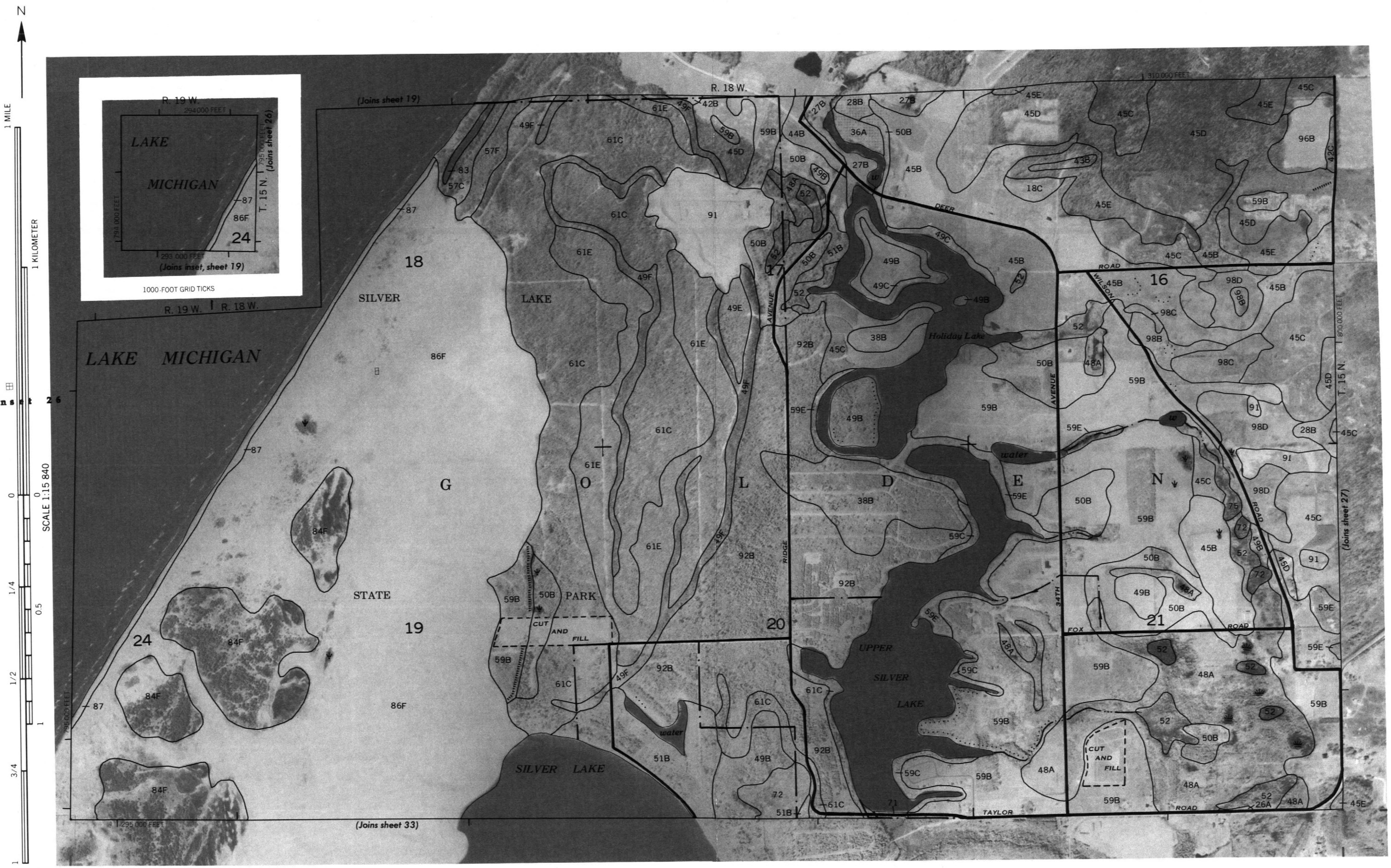
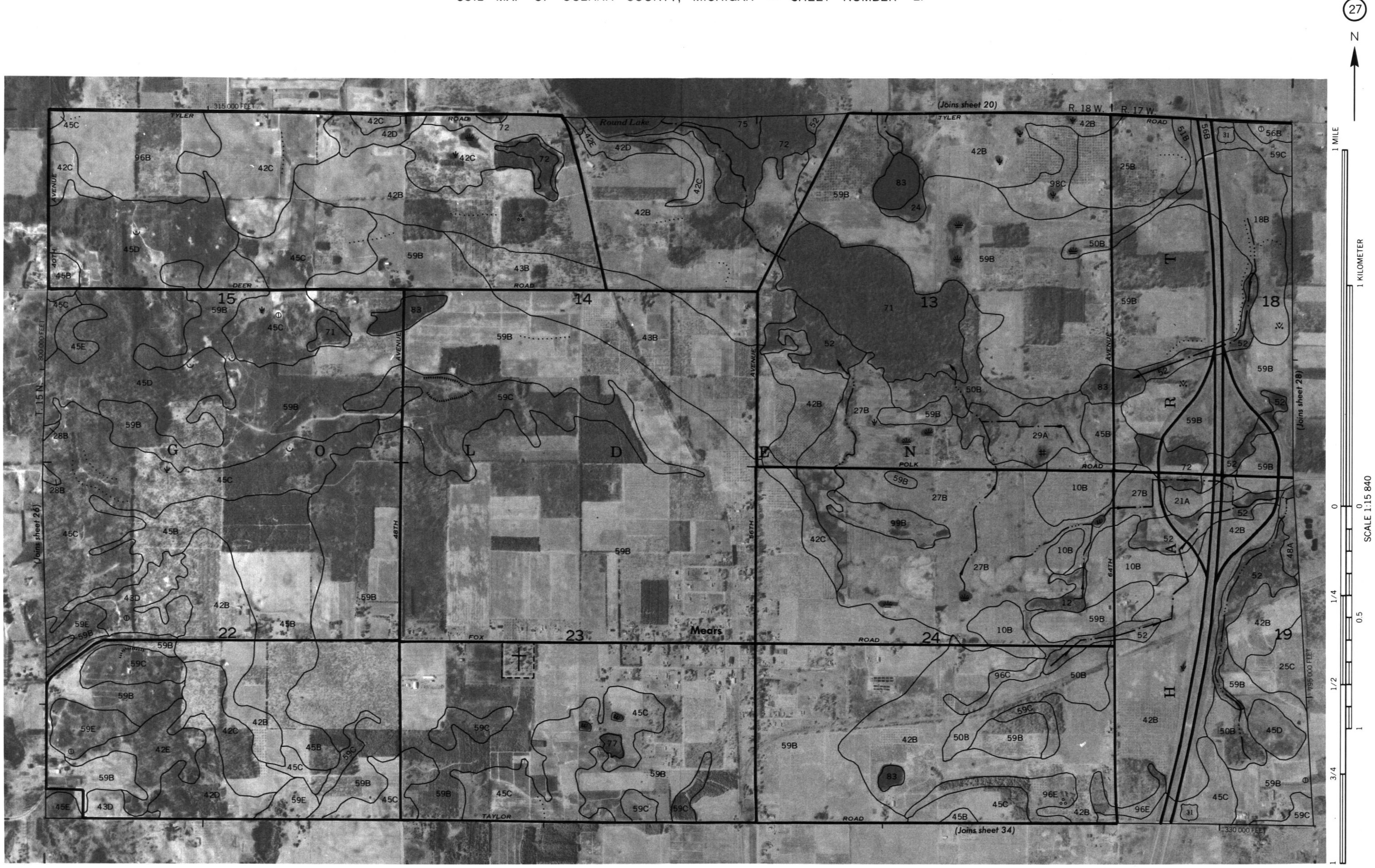
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 26



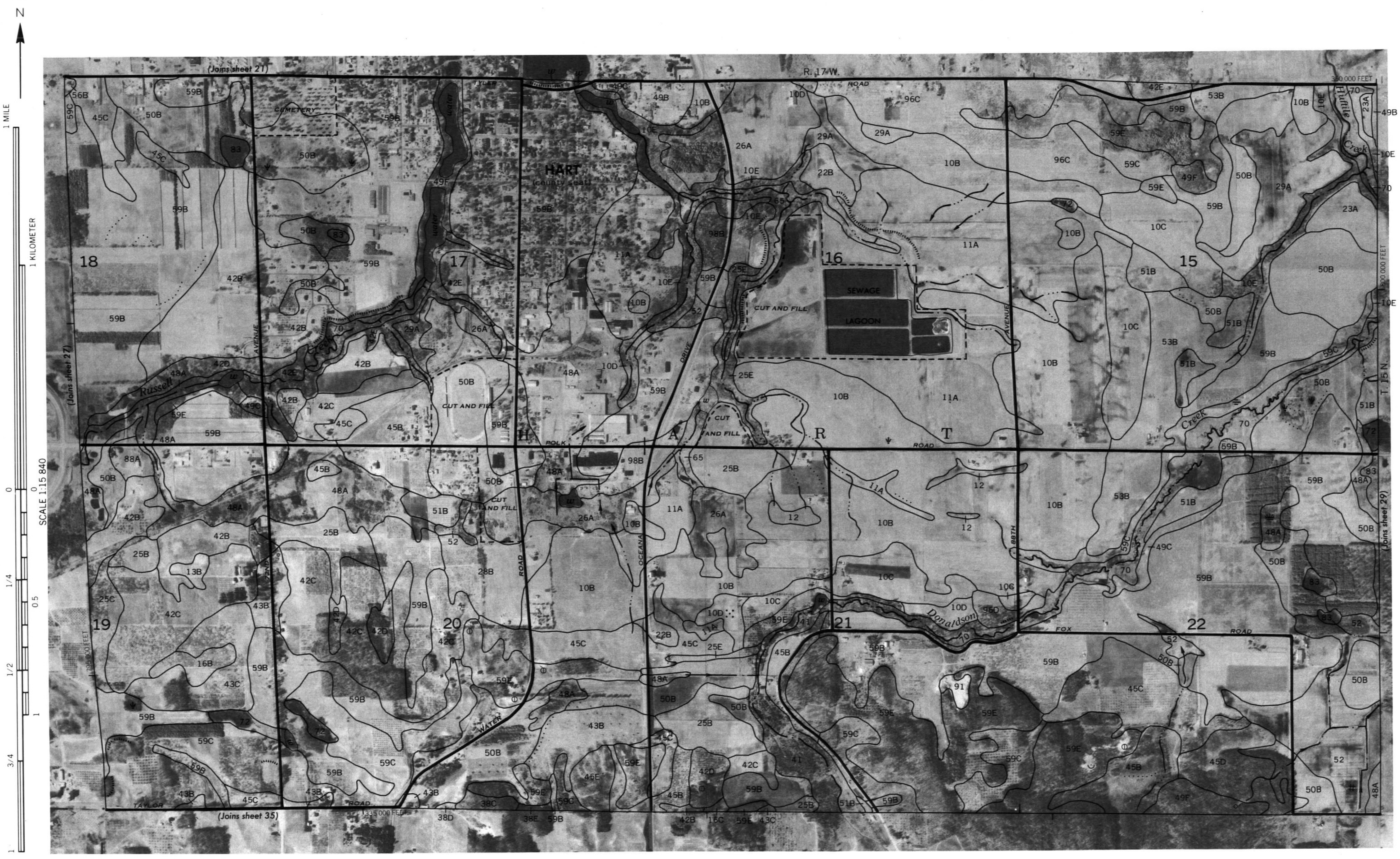
OCEANA COUNTY, MICHIGAN NO. 26

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 27

OCEANA COUNTY, MICHIGAN NO. 27

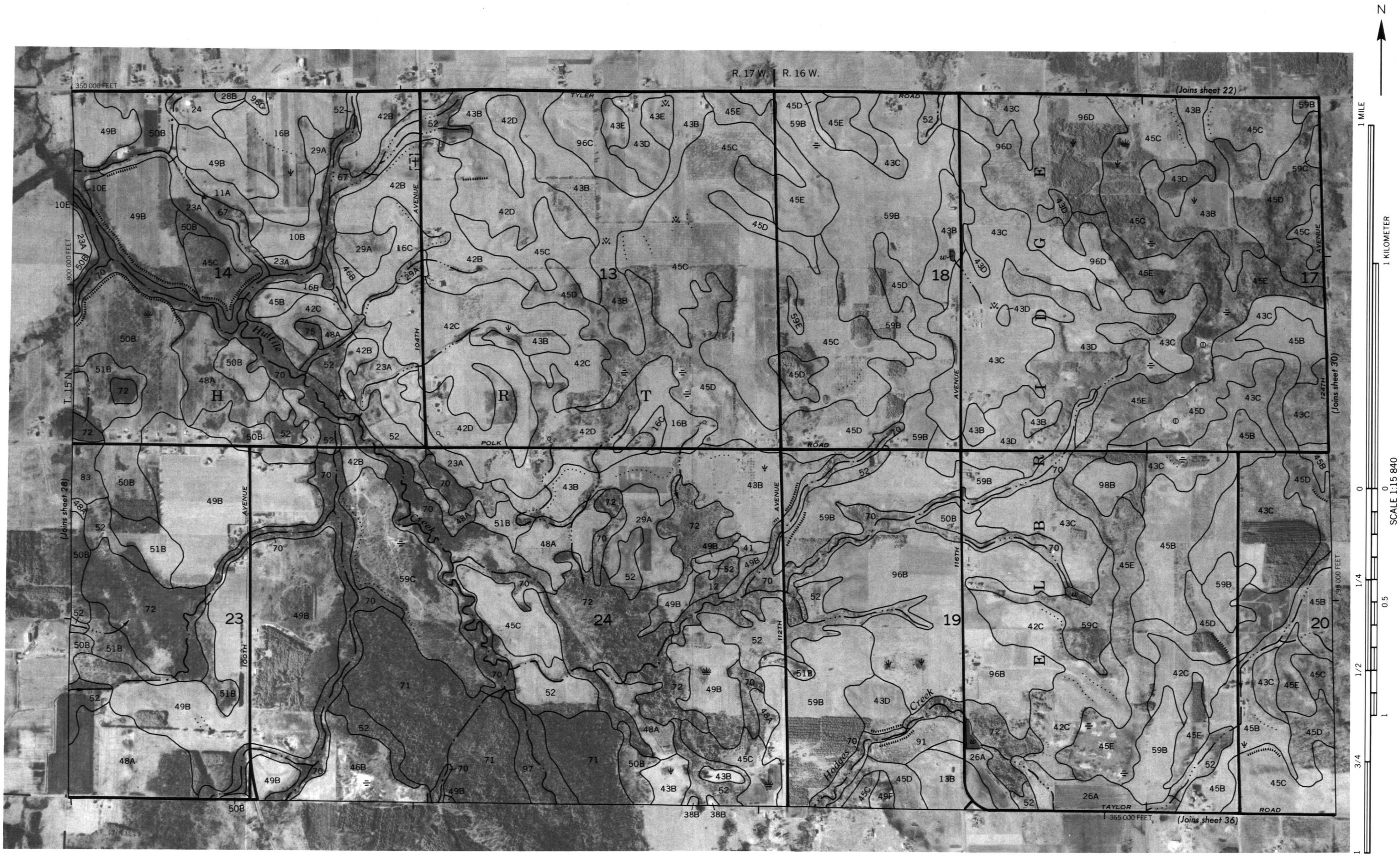


SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 28

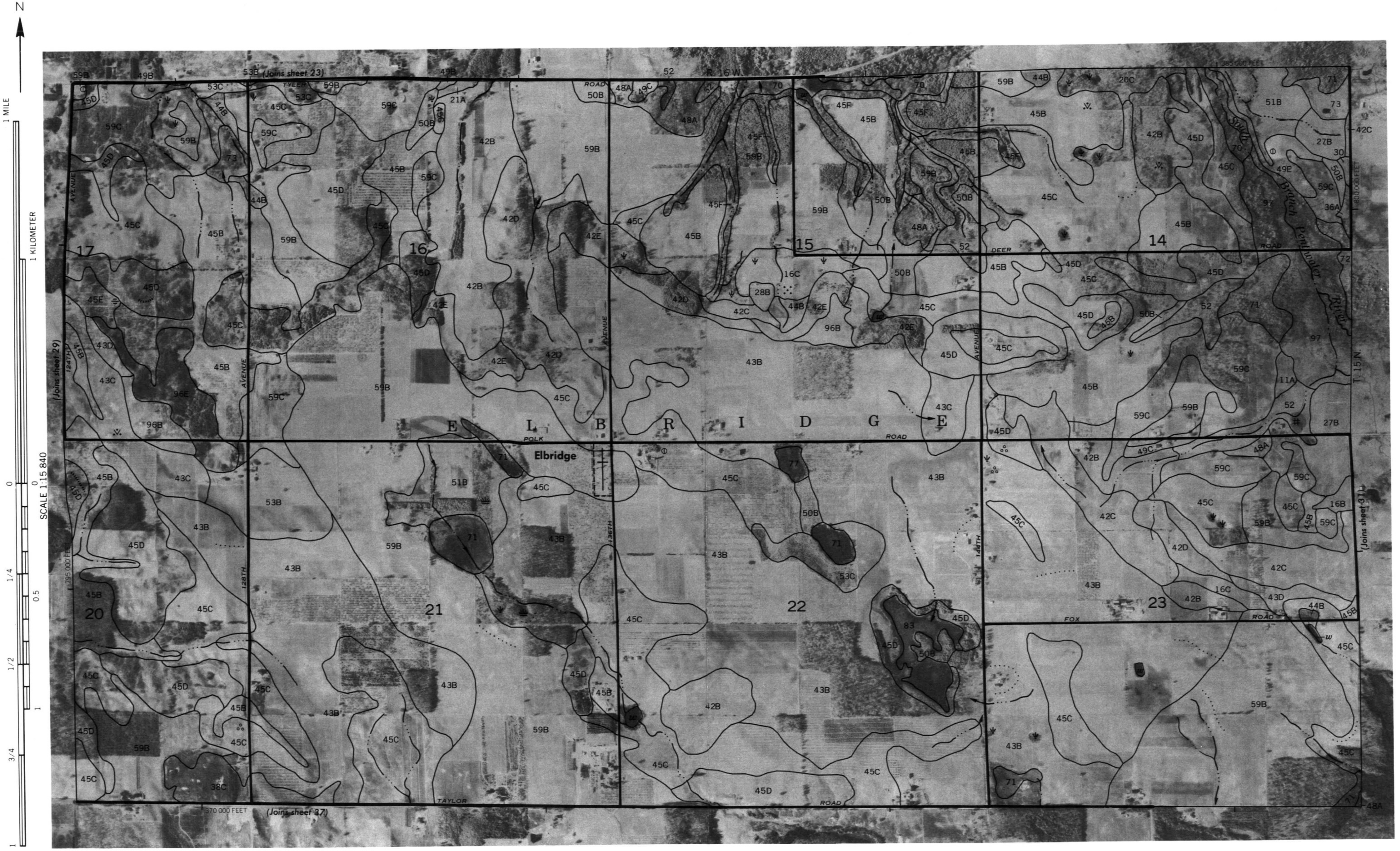


OCEANA COUNTY, MICHIGAN NO. 28

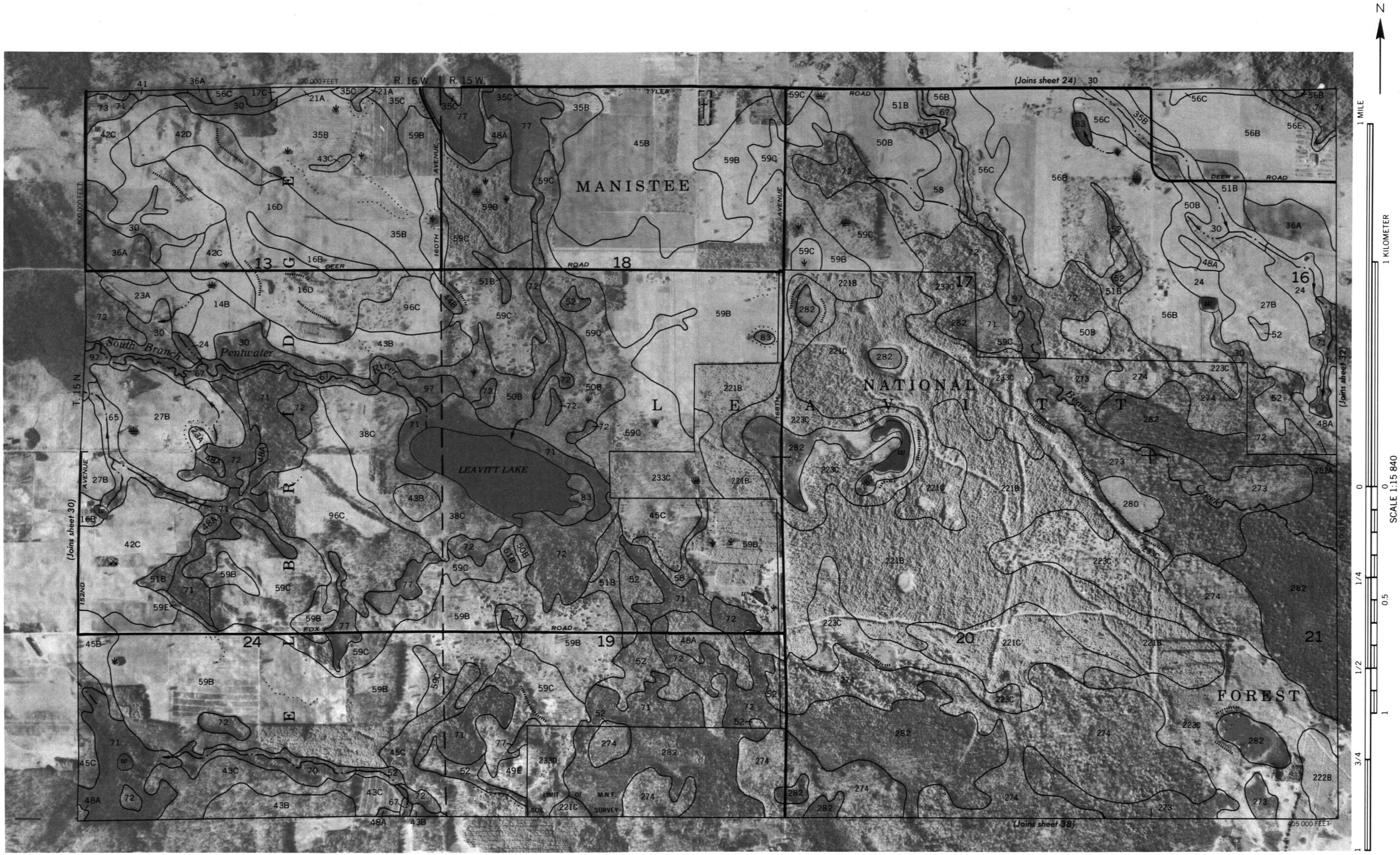
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 29



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 30



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 31



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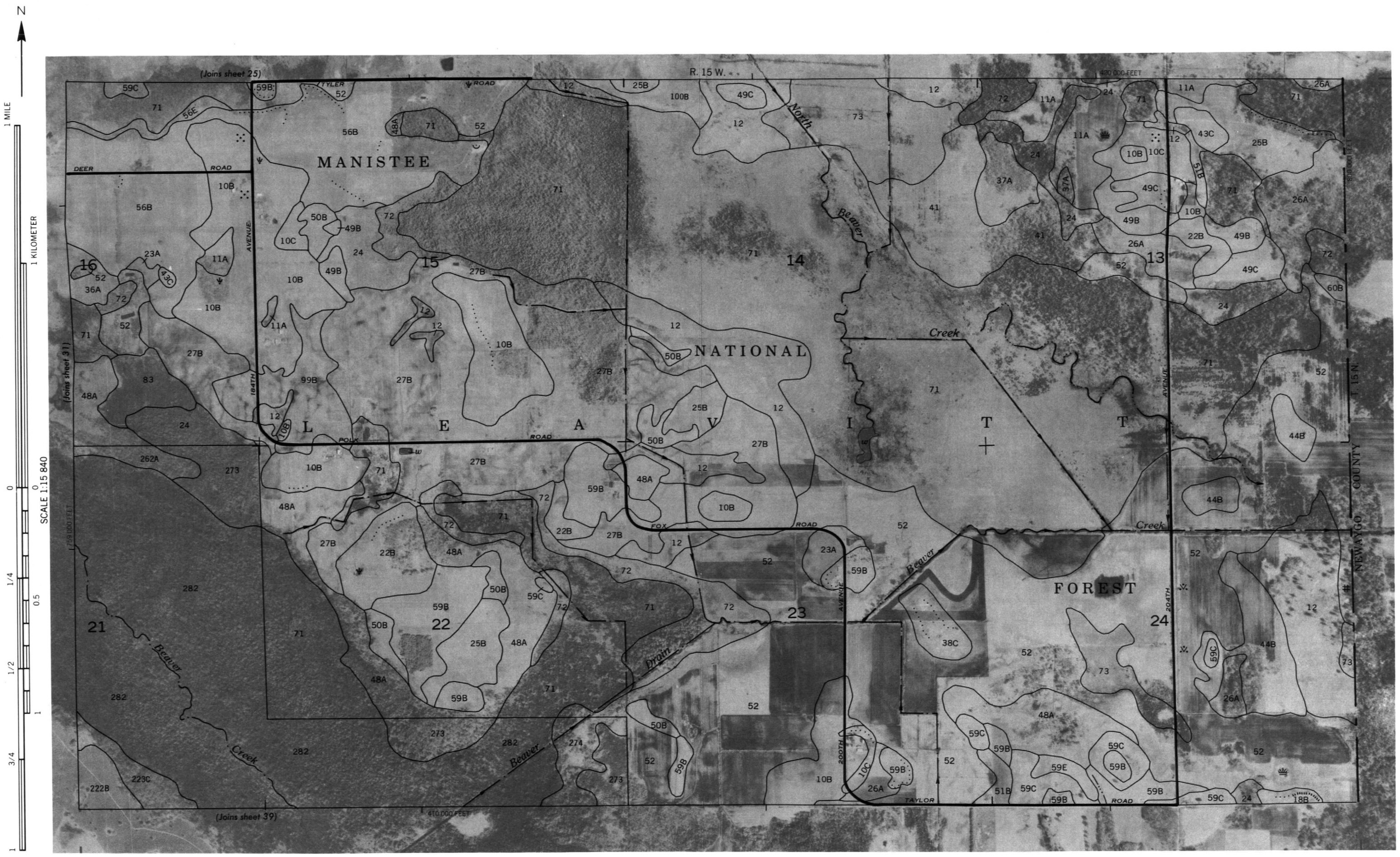
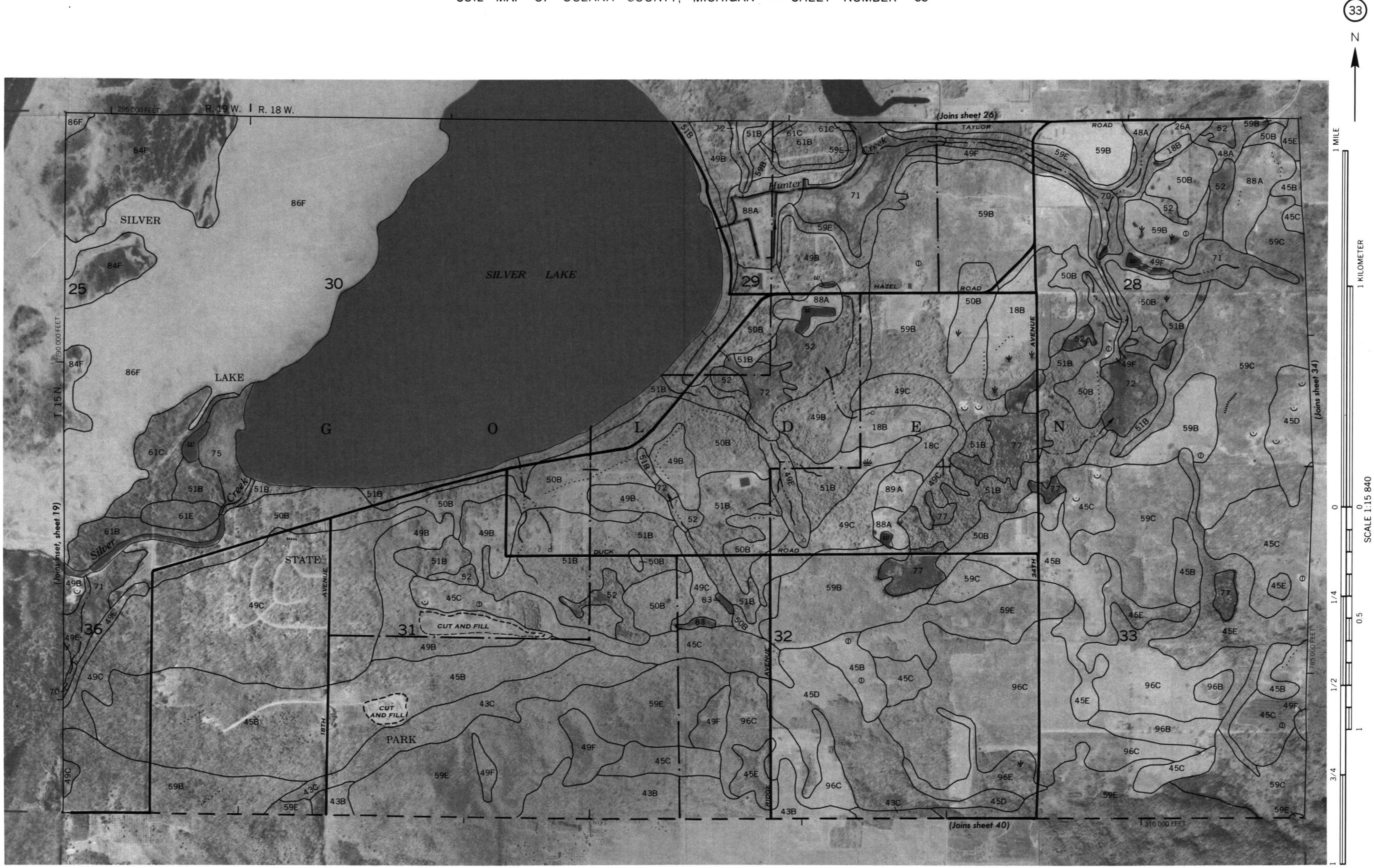
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 32



OCEANA COUNTY, MICHIGAN NO. 32

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 33

OCEANA COUNTY, MICHIGAN NO. 33



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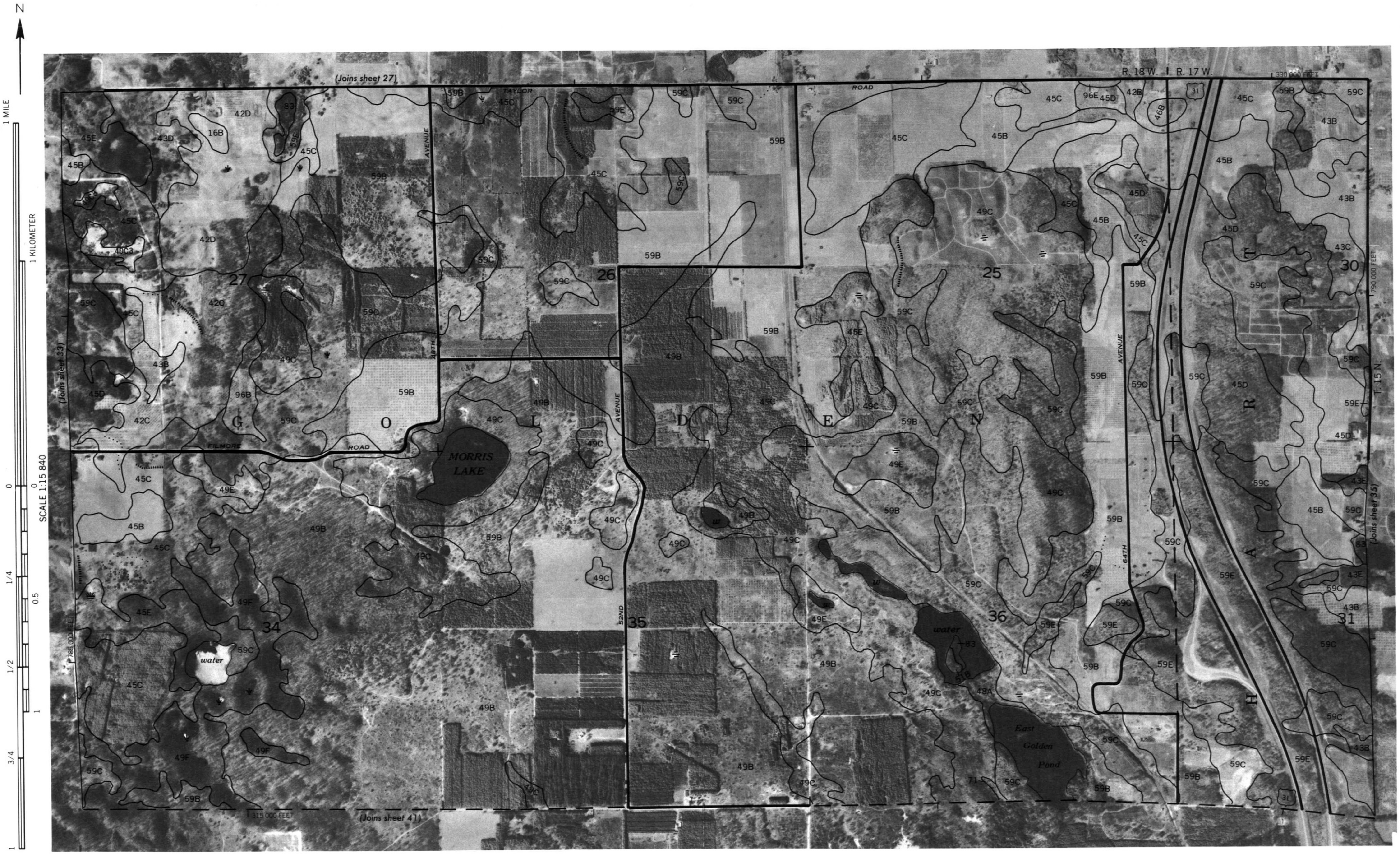
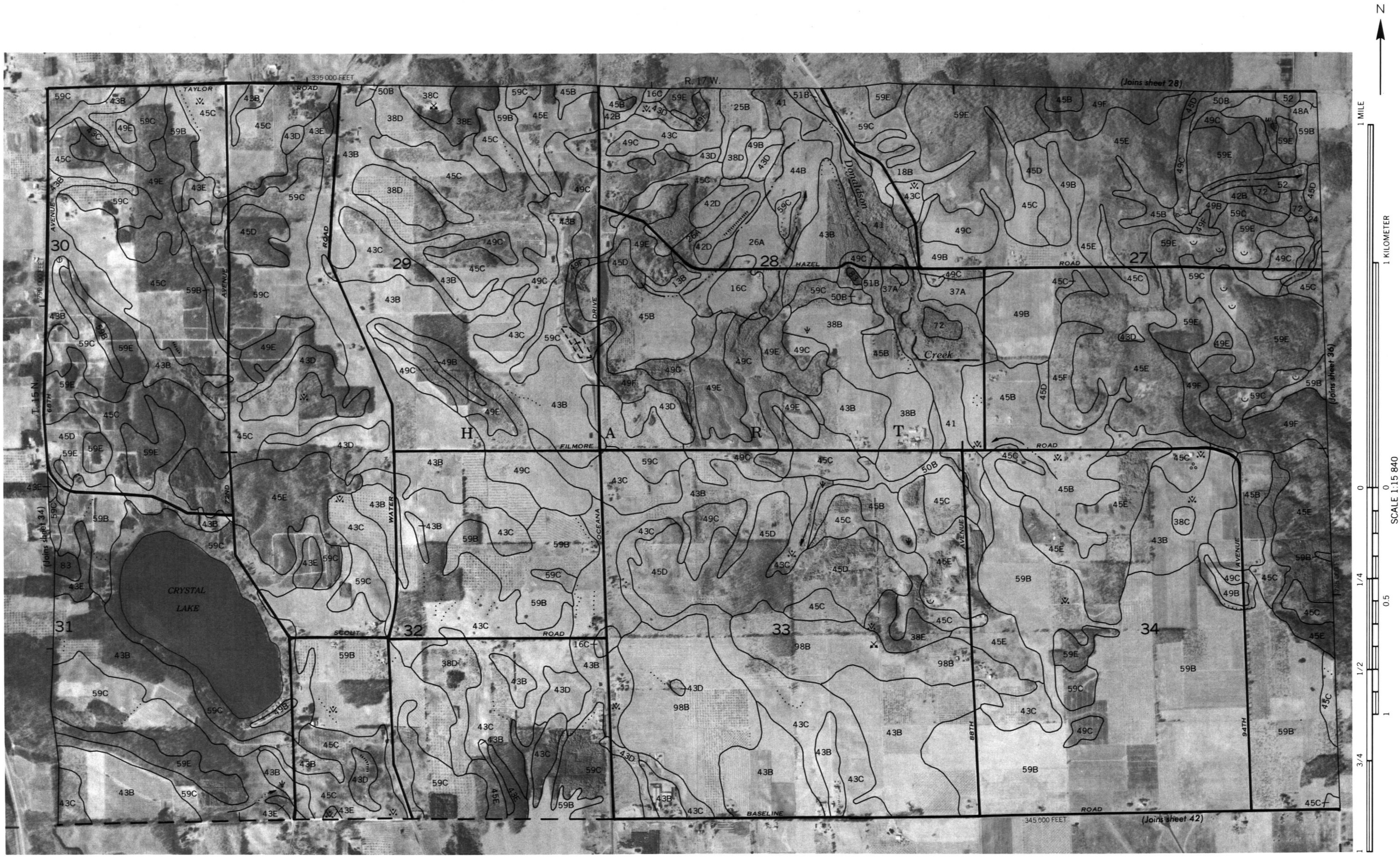
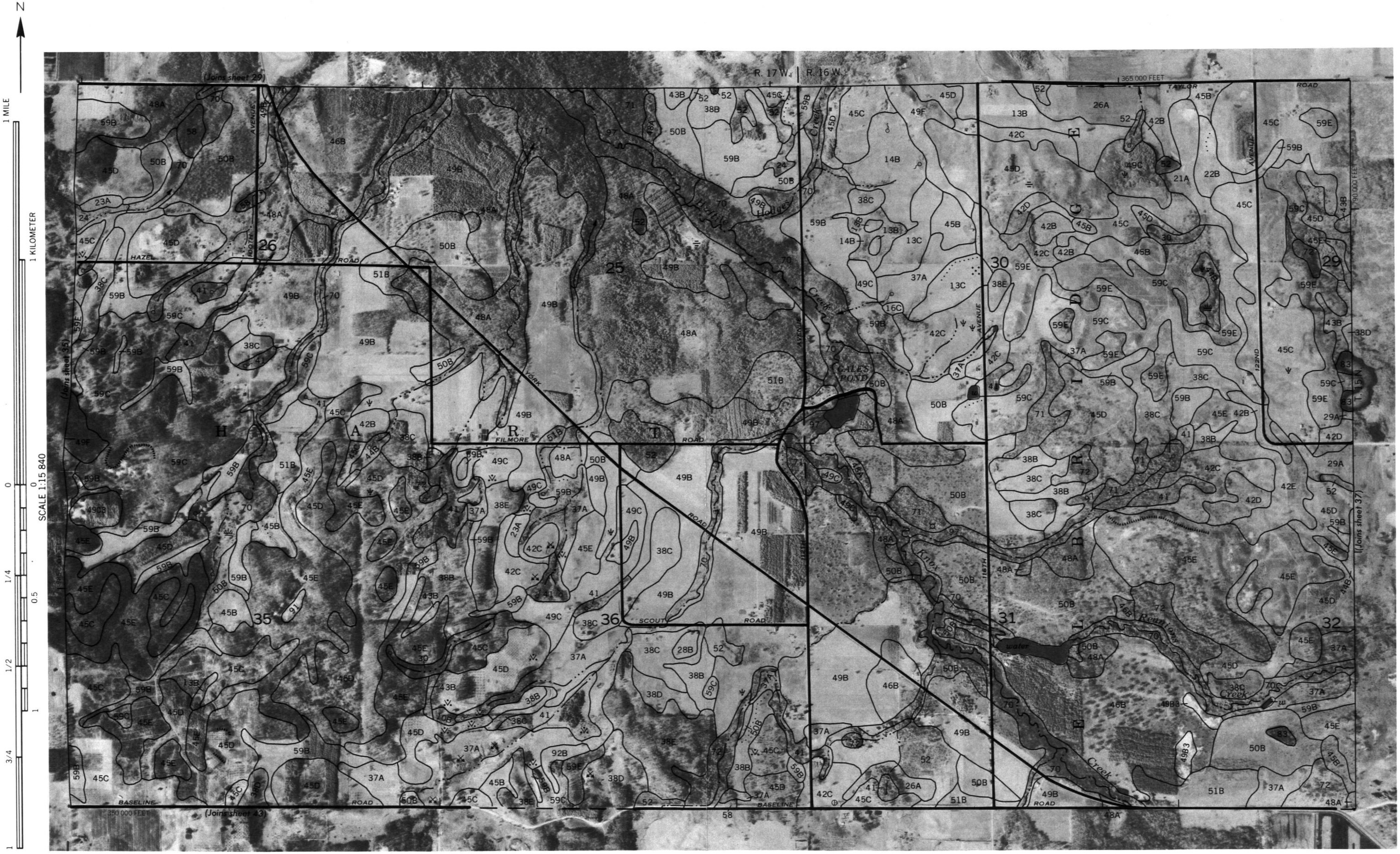


OCEANA COUNTY, MICHIGAN NO. 34

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 35



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 36



OCEANA COUNTY, MICHIGAN NO. 36

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 37

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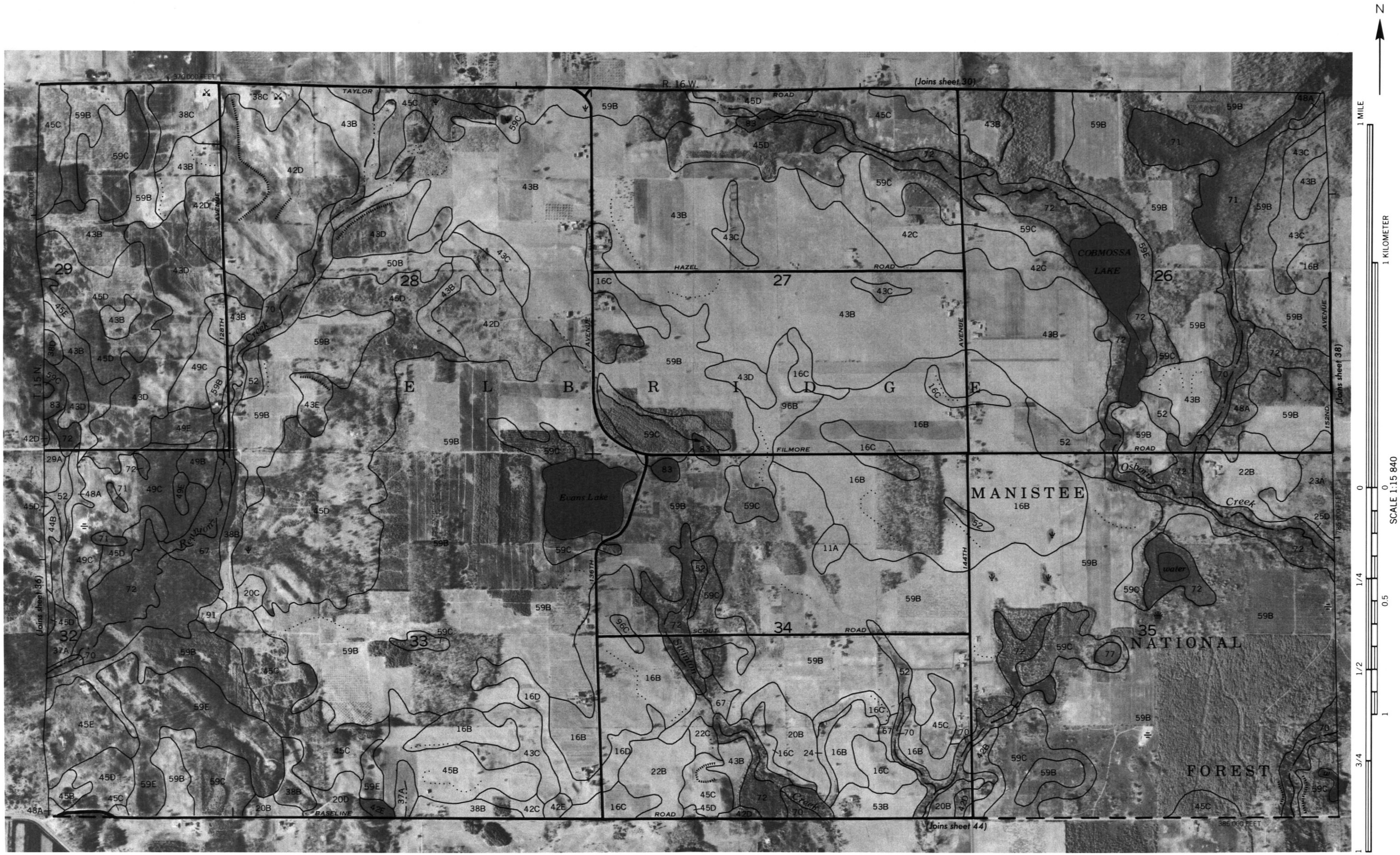
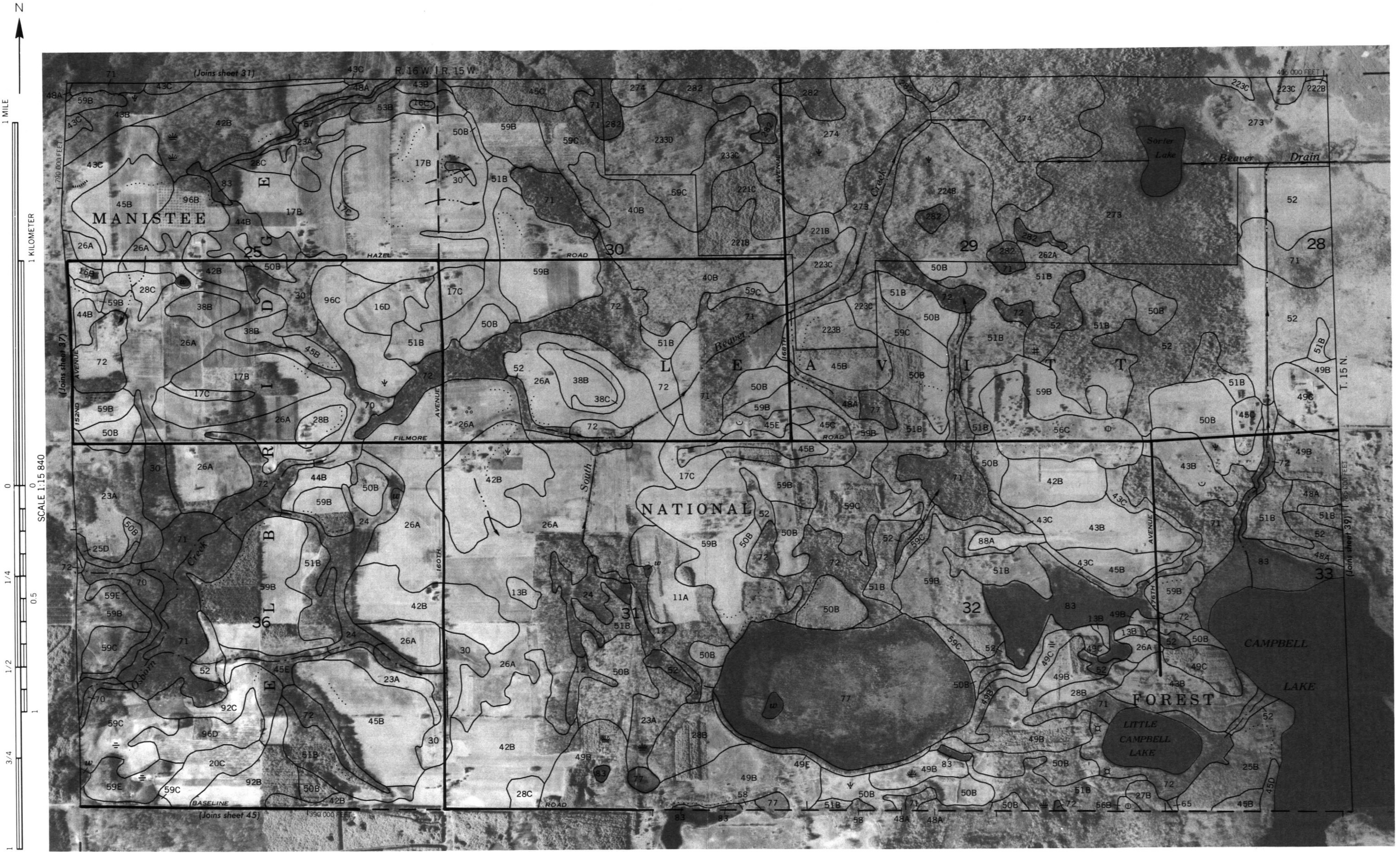
OCEANA COUNTY, MICHIGAN NO. 37



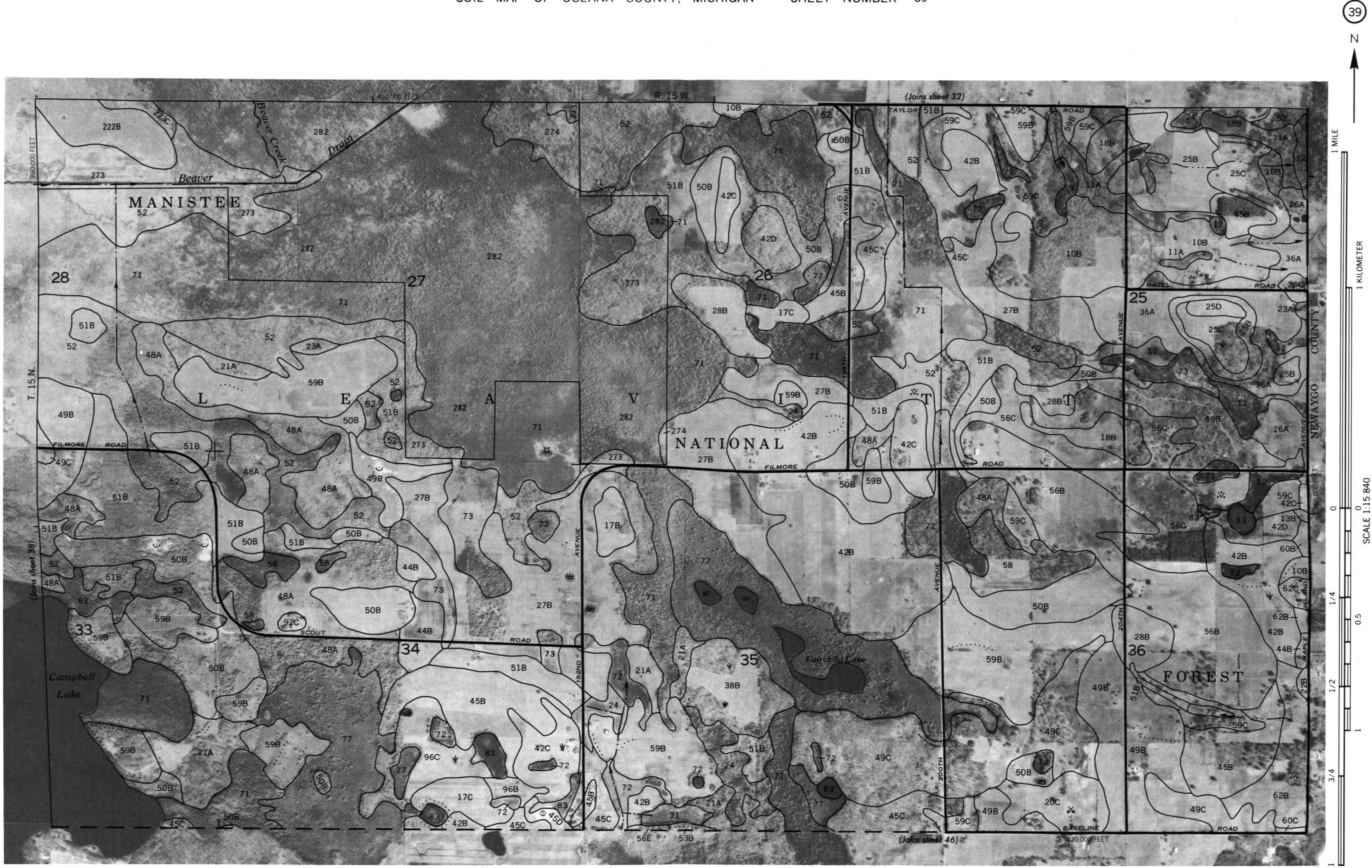
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 38



OCEANA COUNTY, MICHIGAN NO. 38

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 39

OCEANA COUNTY, MICHIGAN NO. 39



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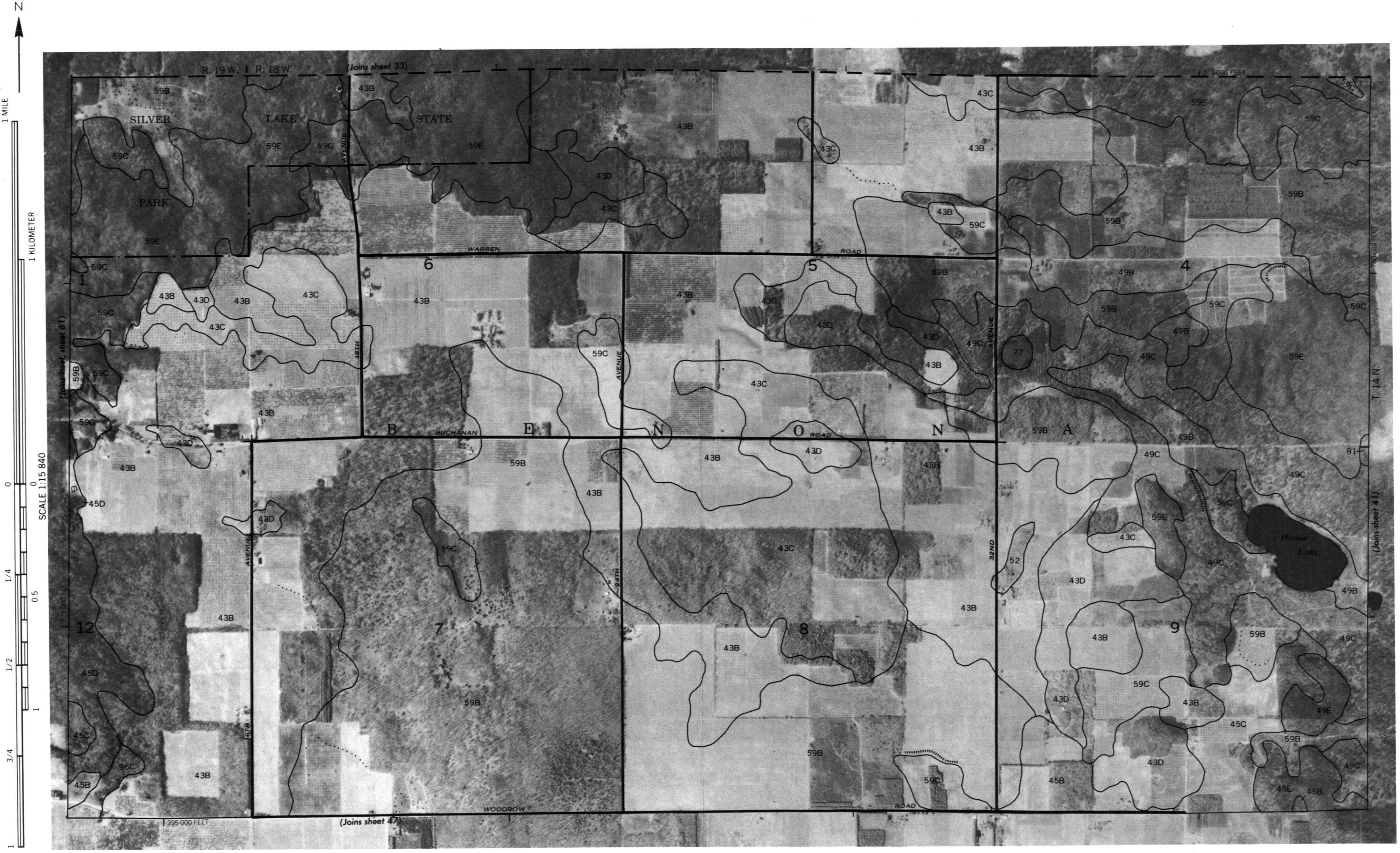
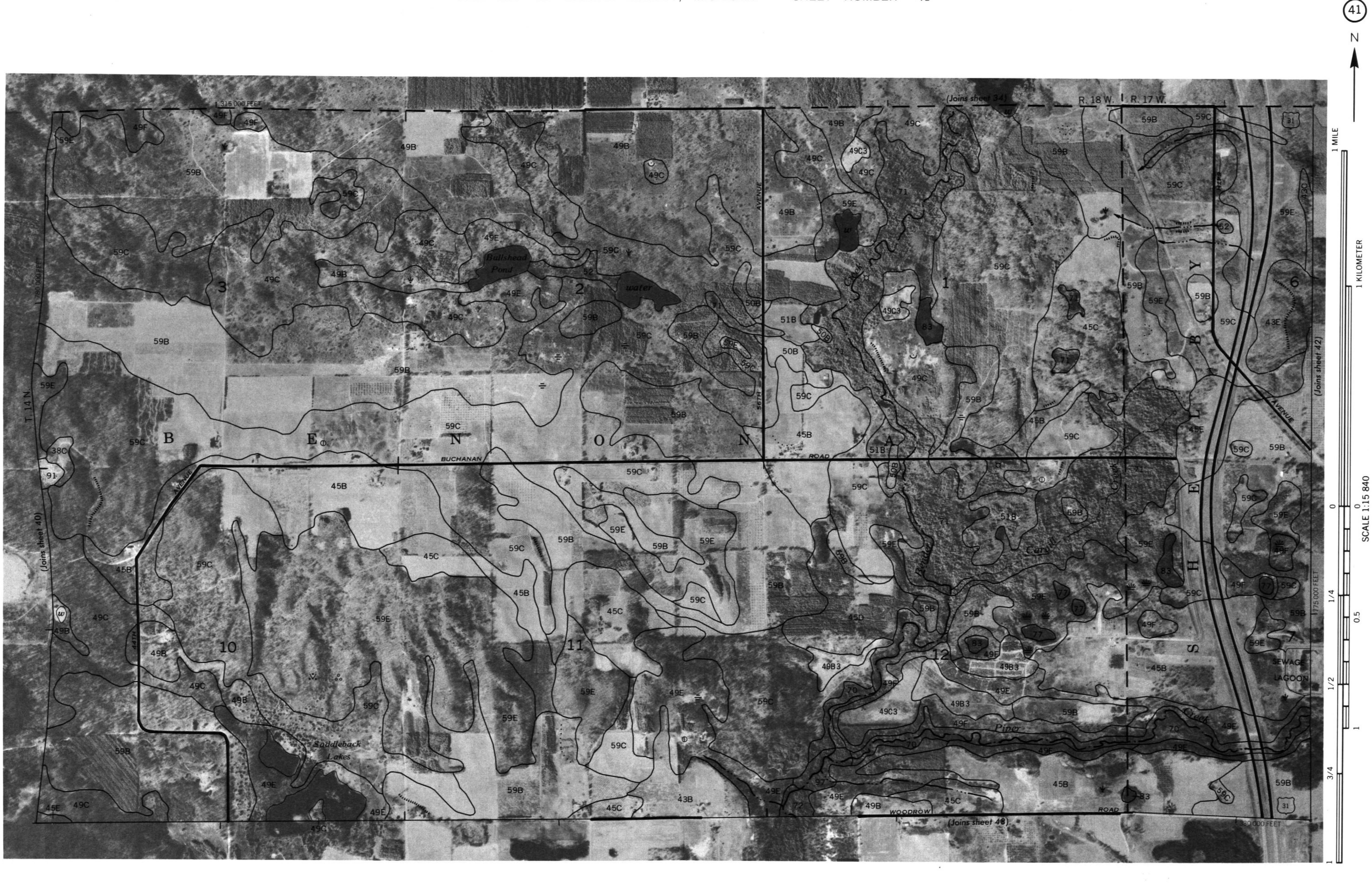
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 40



OCEANA COUNTY, MICHIGAN NO. 40

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 41



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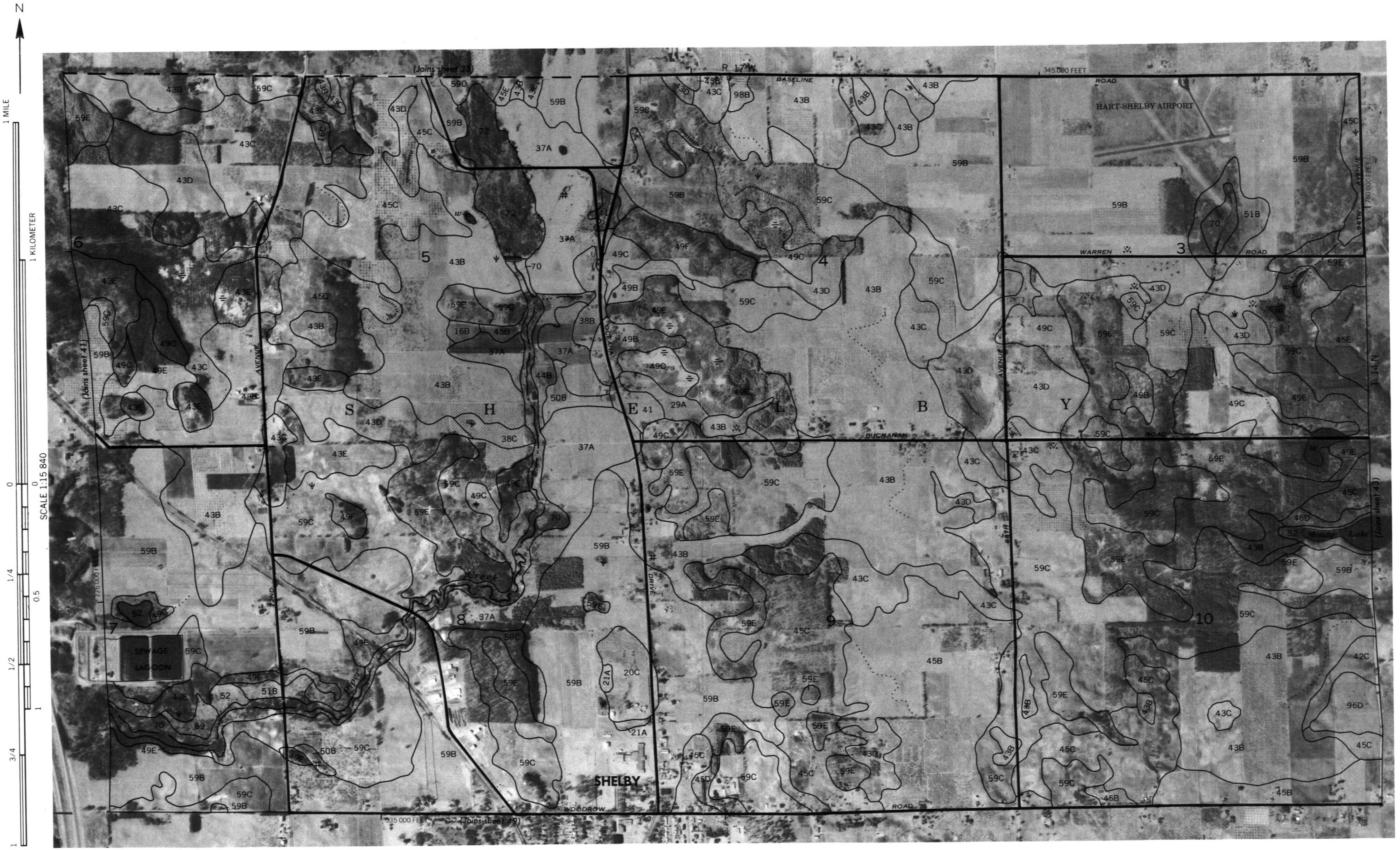
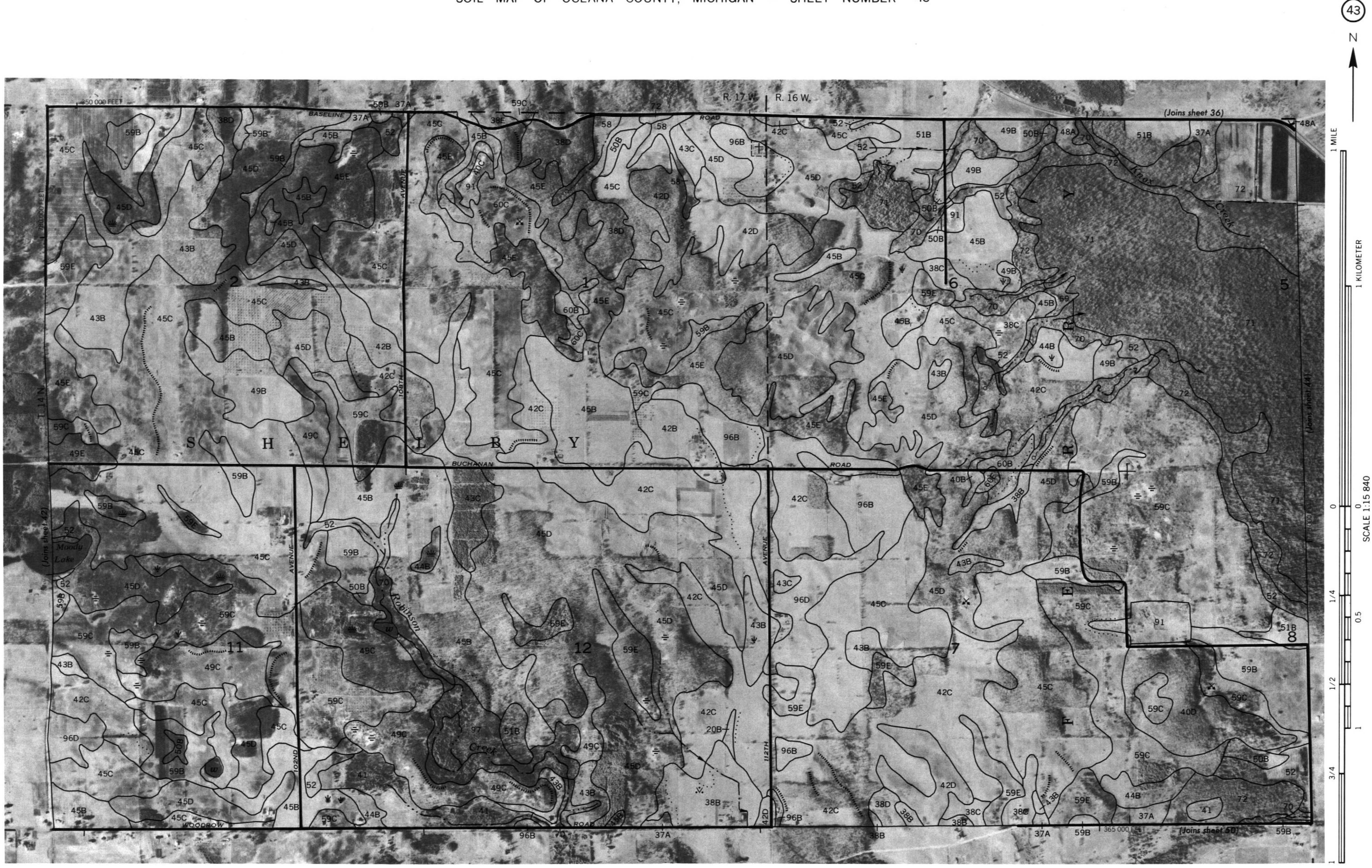
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 42



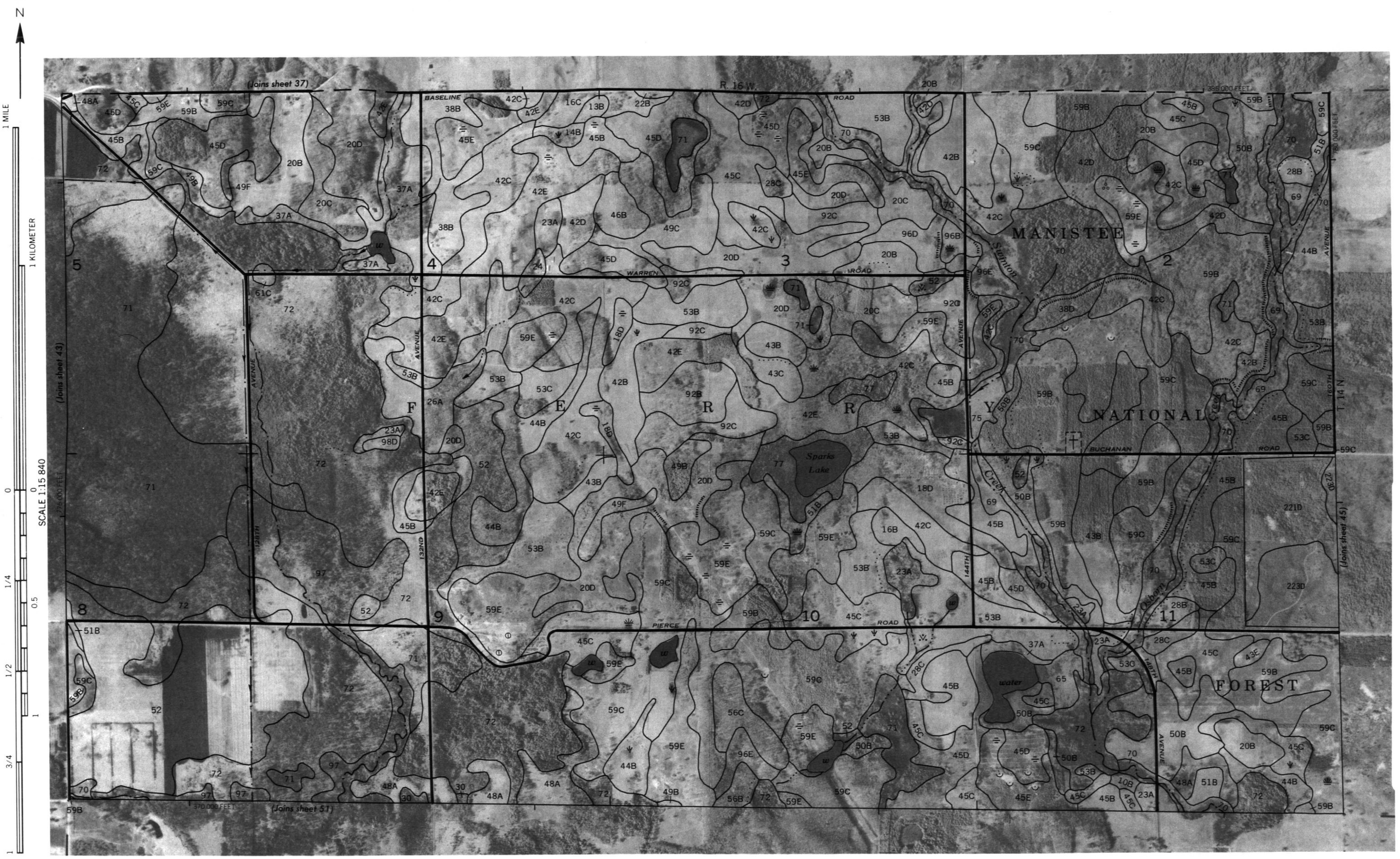
OCEANA COUNTY, MICHIGAN NO. 42

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 43

OCEANA COUNTY, MICHIGAN NO. 43



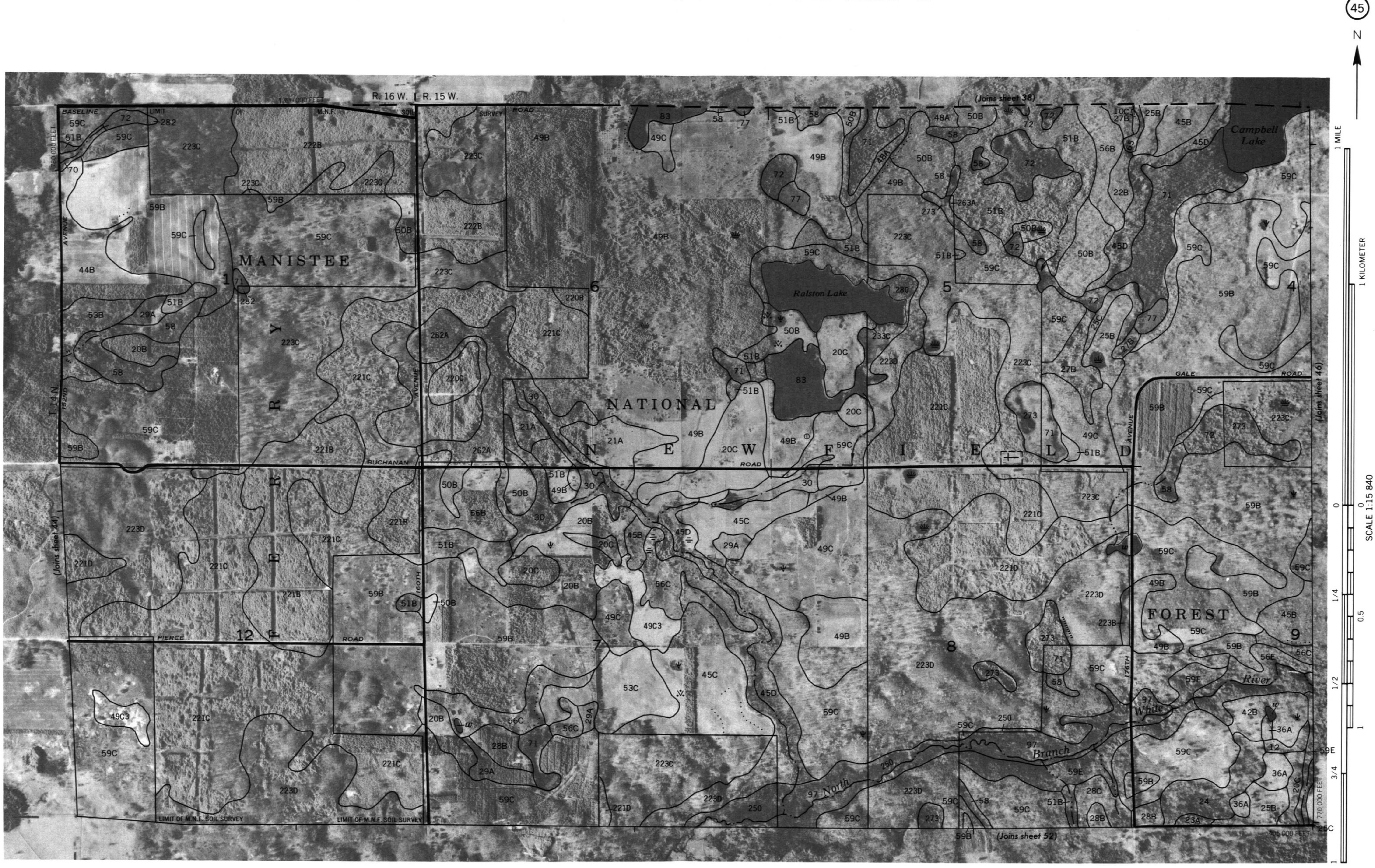
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 44



OCEANA COUNTY, MICHIGAN NO. 44

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 45

OCEANA COUNTY, MICHIGAN NO. 45



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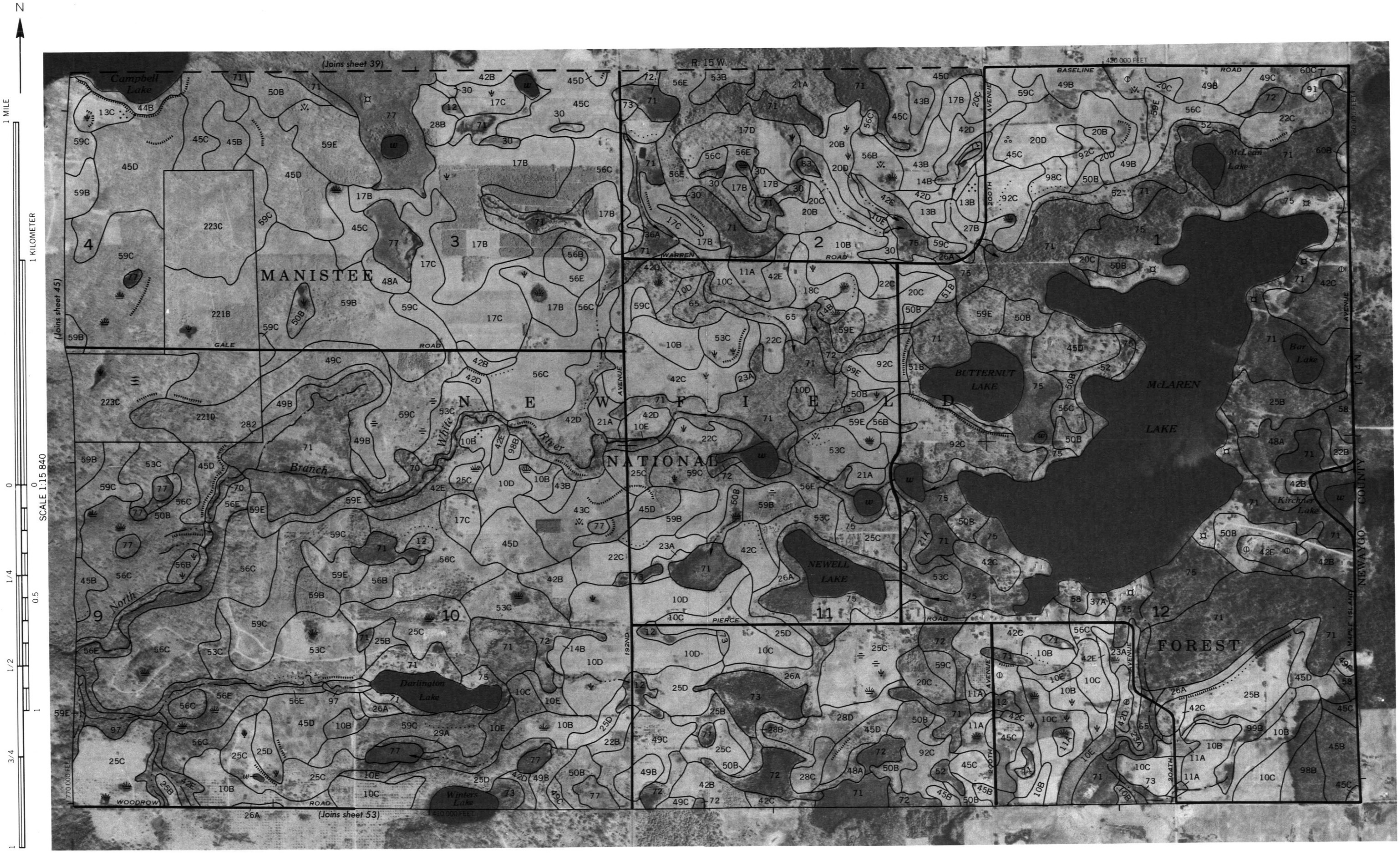

OCEANA COUNTY, MICHIGAN NO. 46

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 47

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OCEANA COUNTY, MICHIGAN NO. 47

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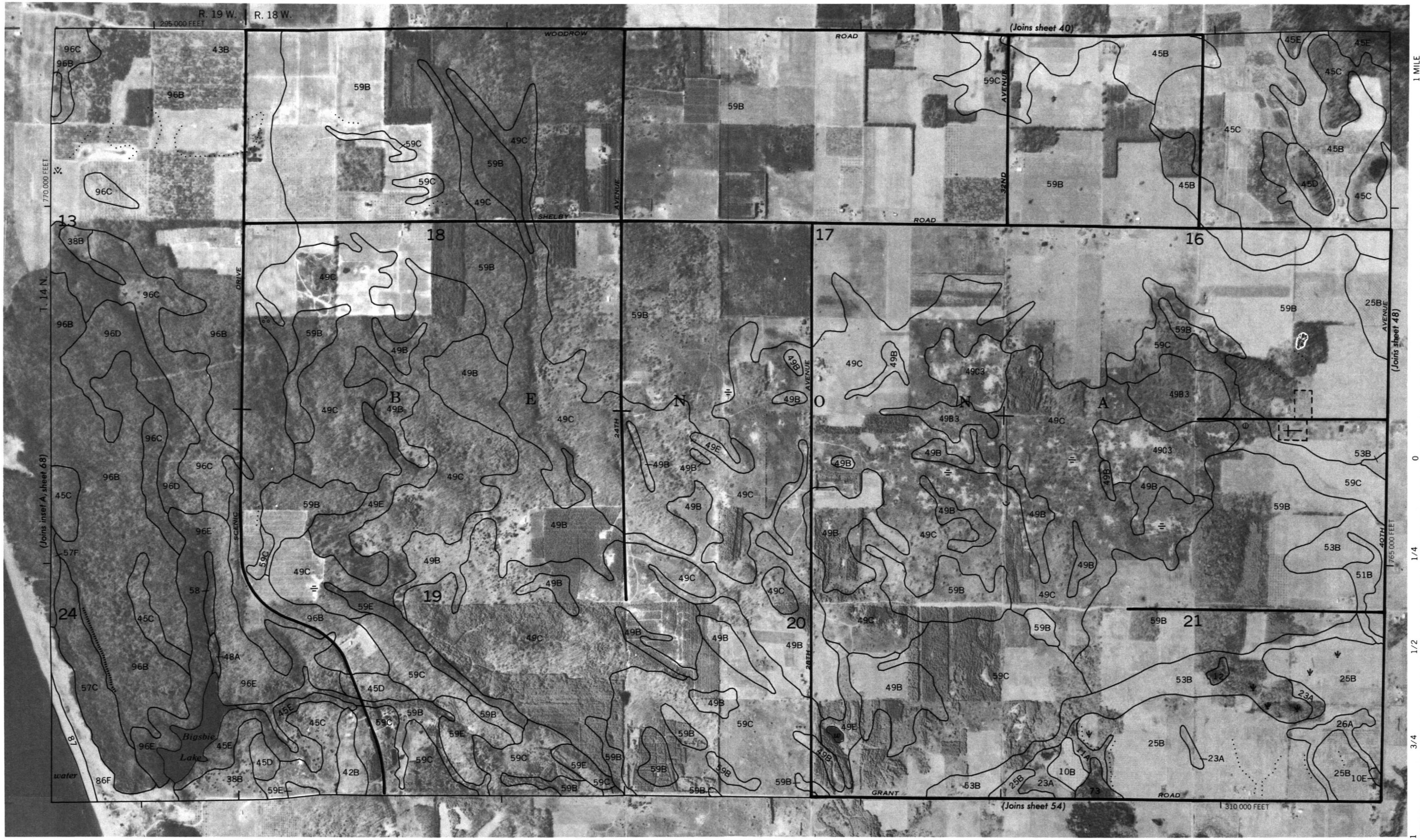

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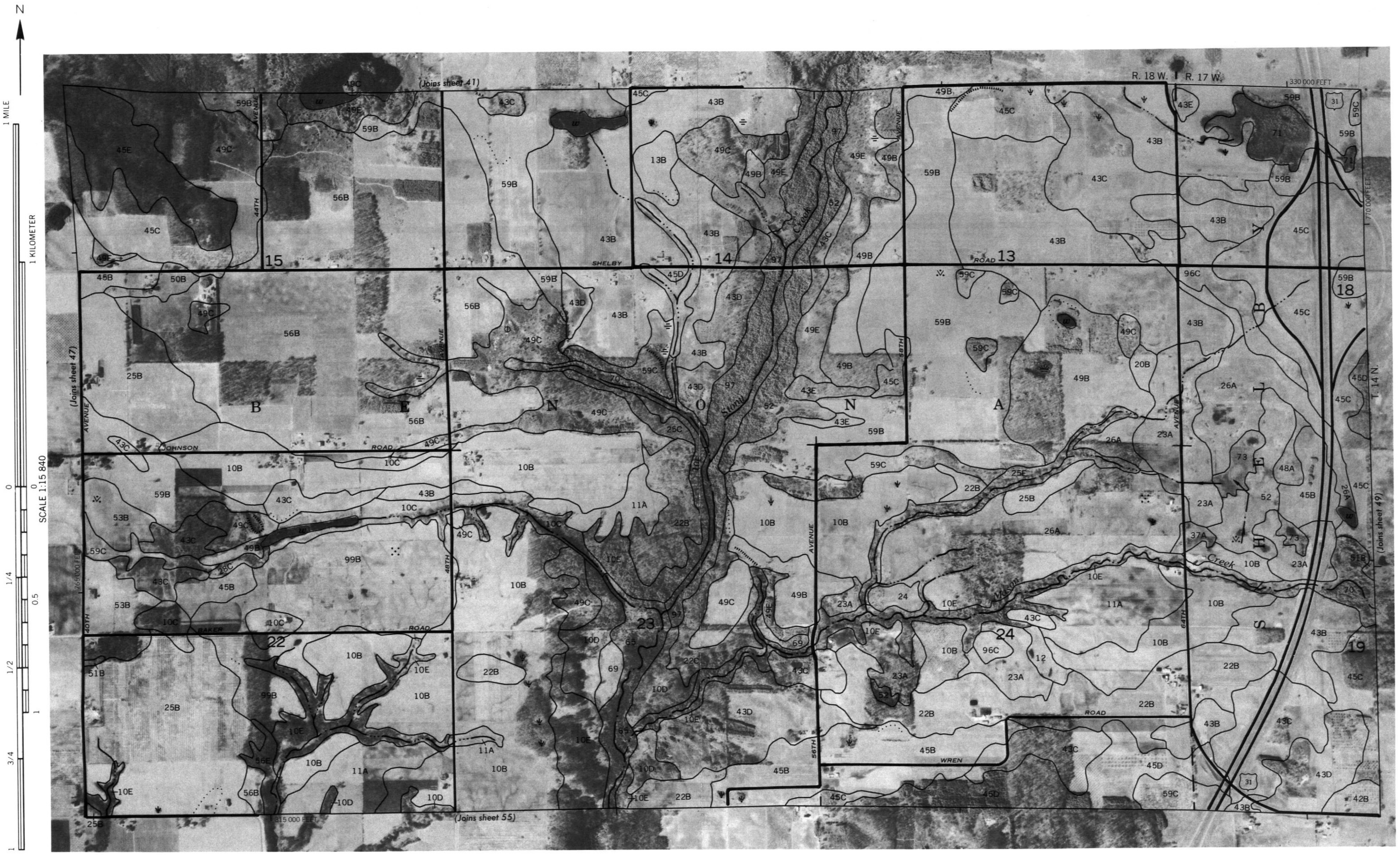
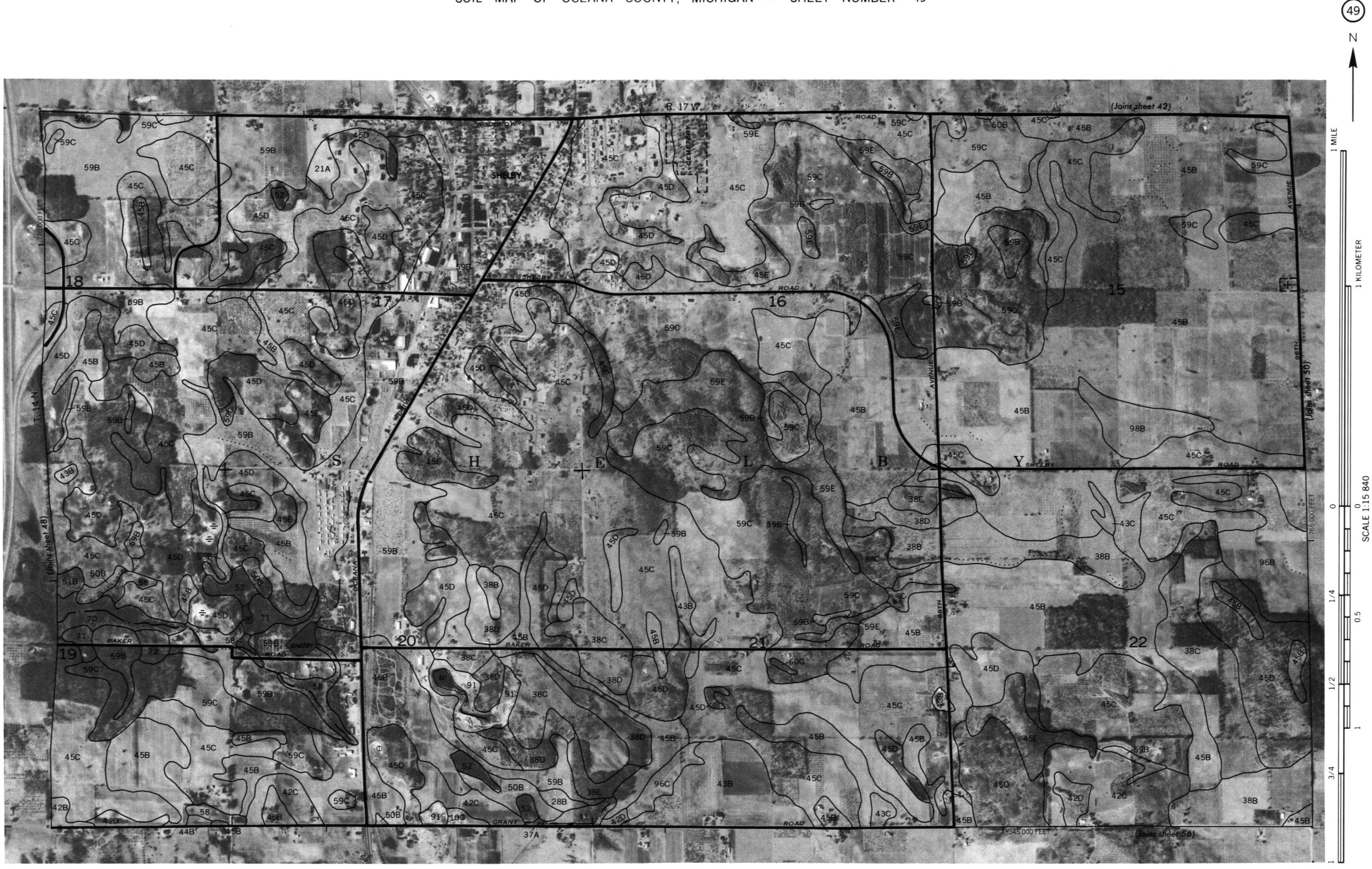
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 48



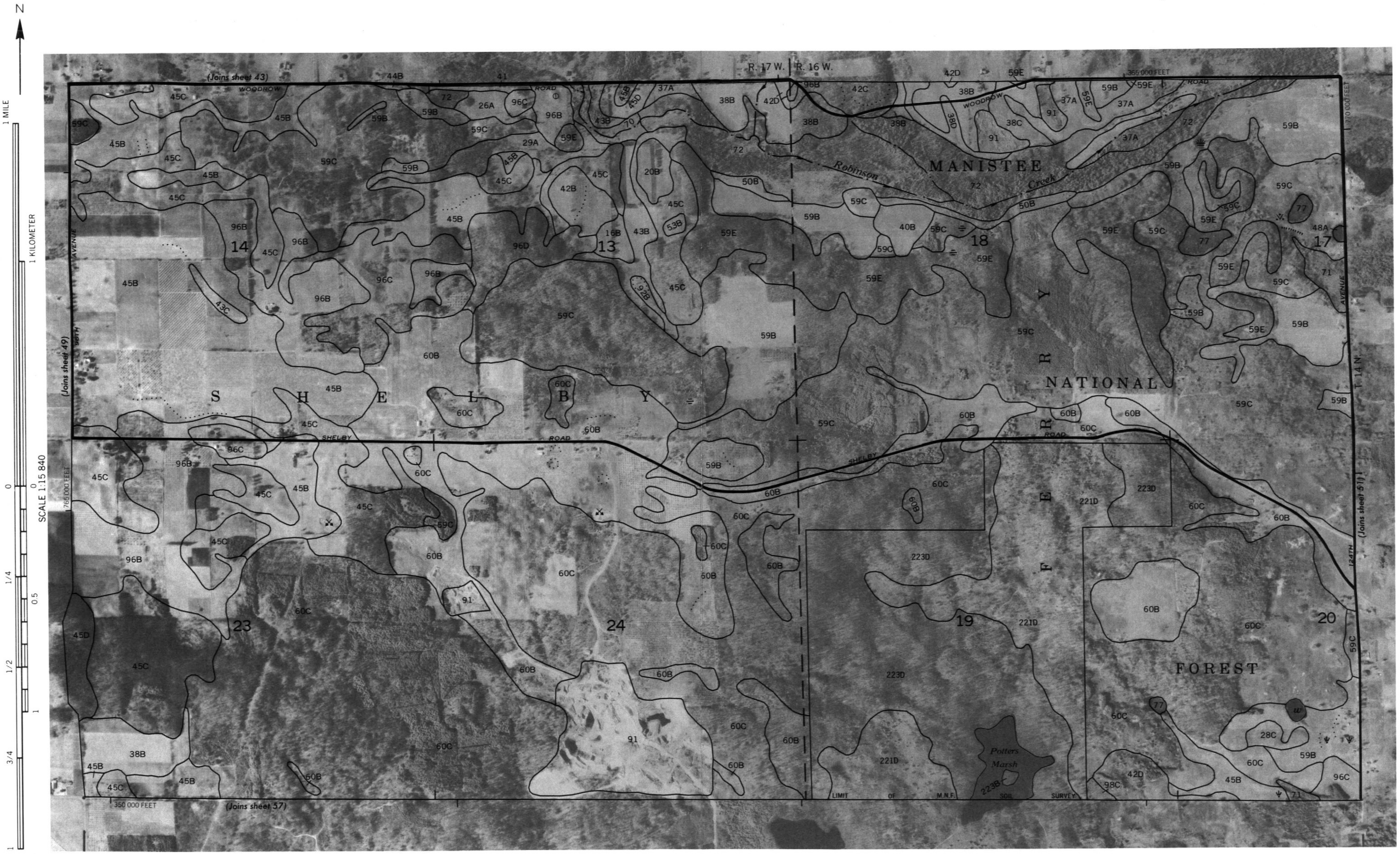
OCEANA COUNTY, MICHIGAN NO. 48

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 49

OCEANA COUNTY, MICHIGAN NO. 49



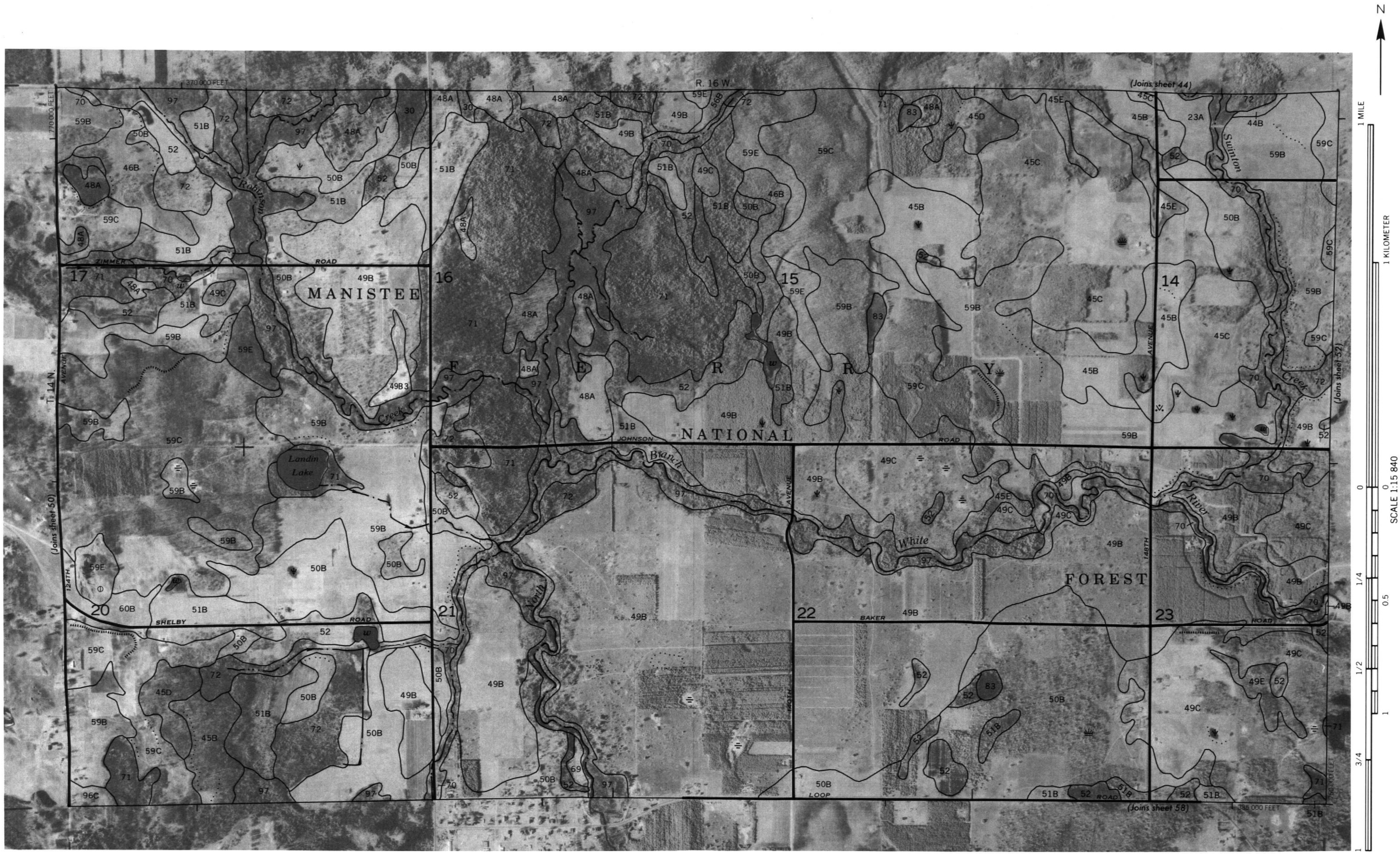
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 50



OCEANA COUNTY, MICHIGAN NO. 50

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 51

OCEANA COUNTY, MICHIGAN NO. 51



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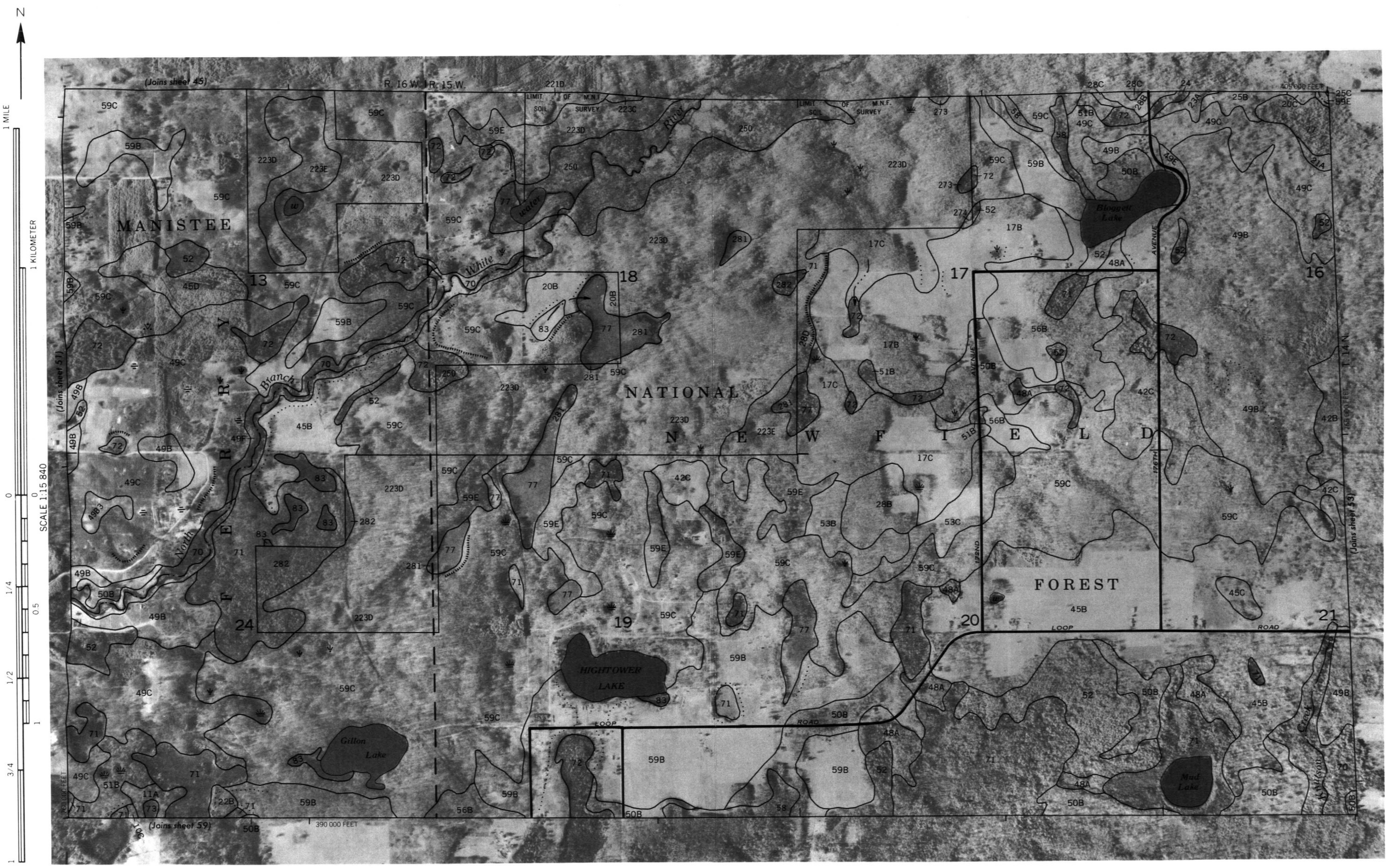
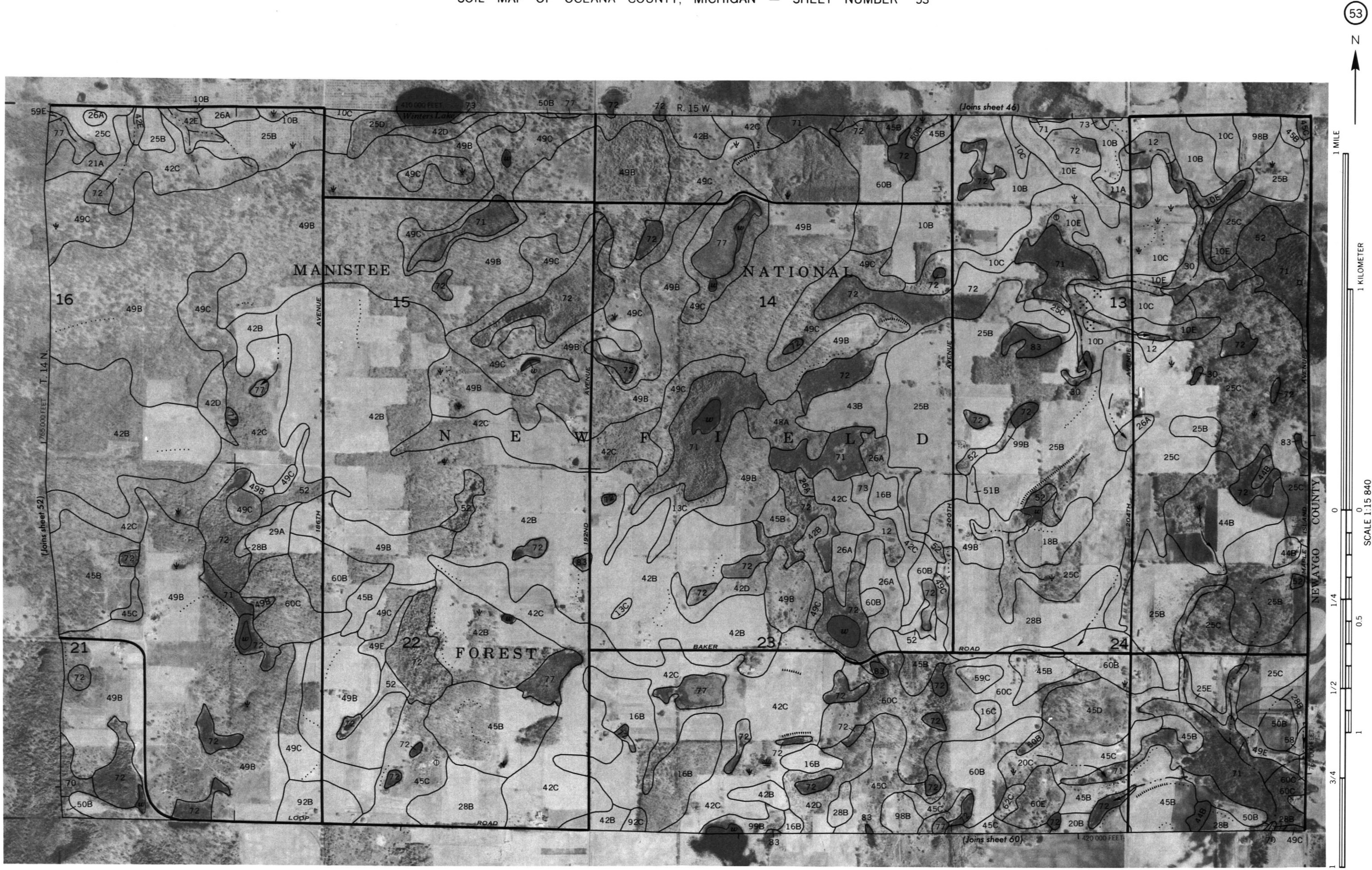


SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 53



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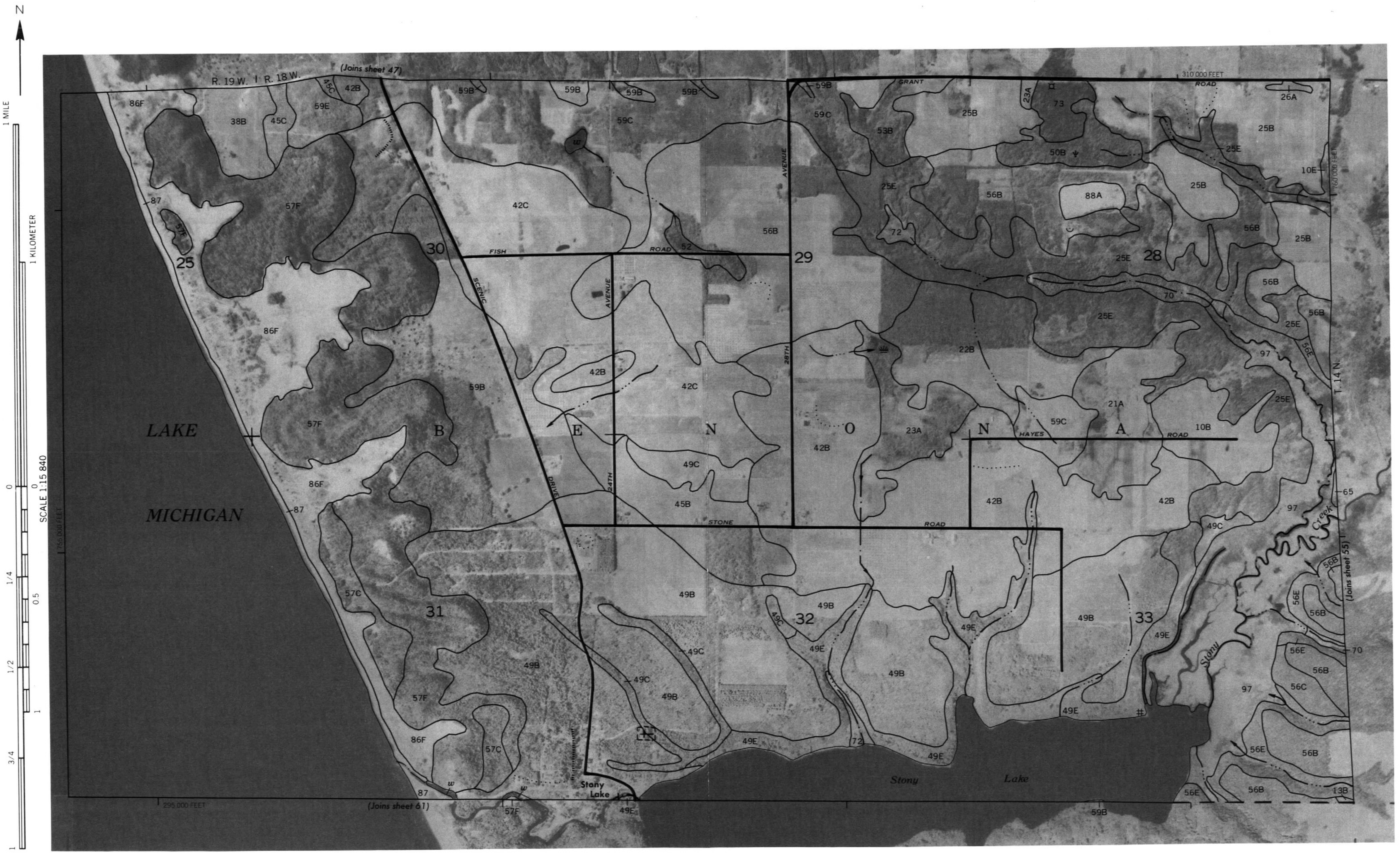
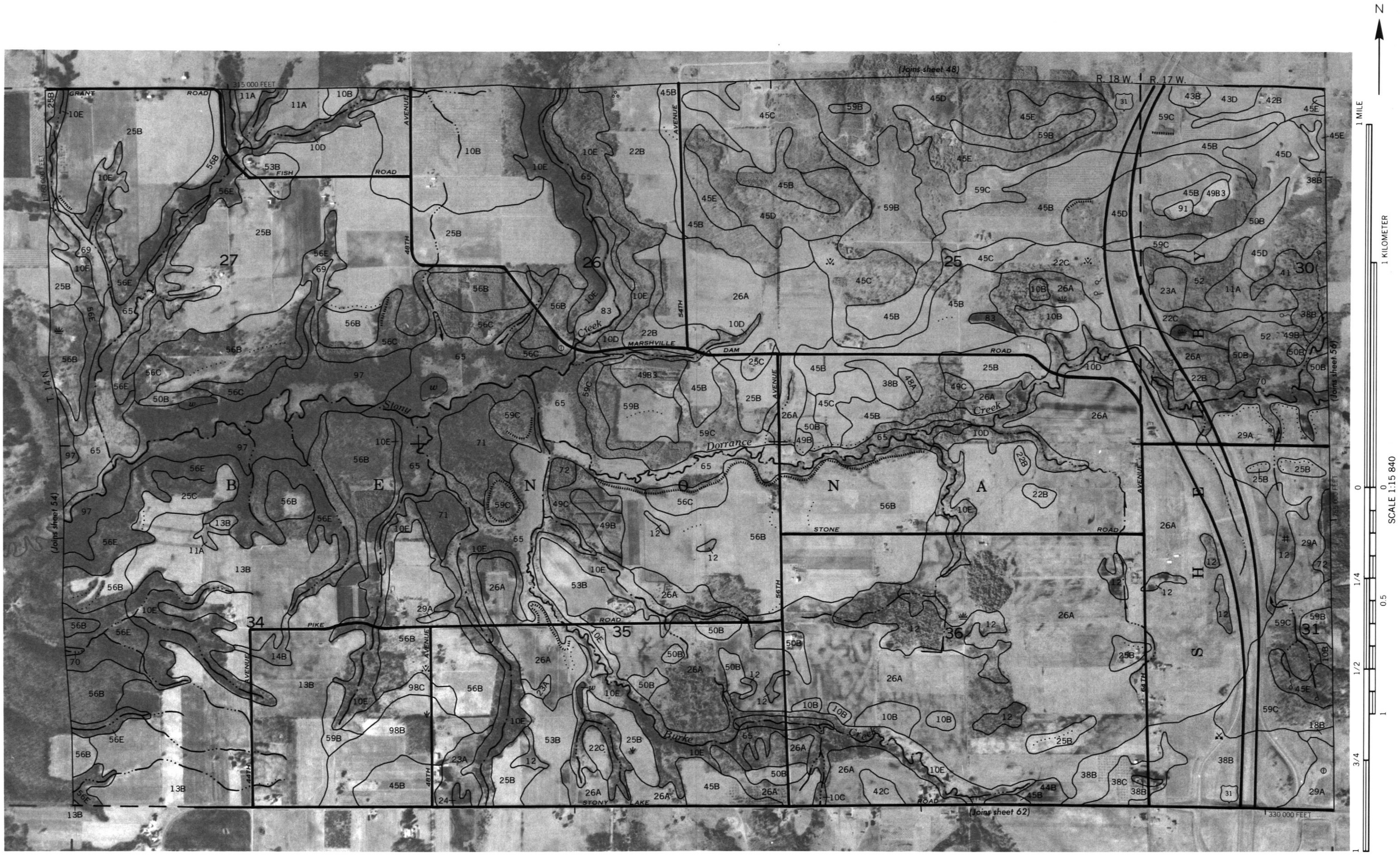
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 54

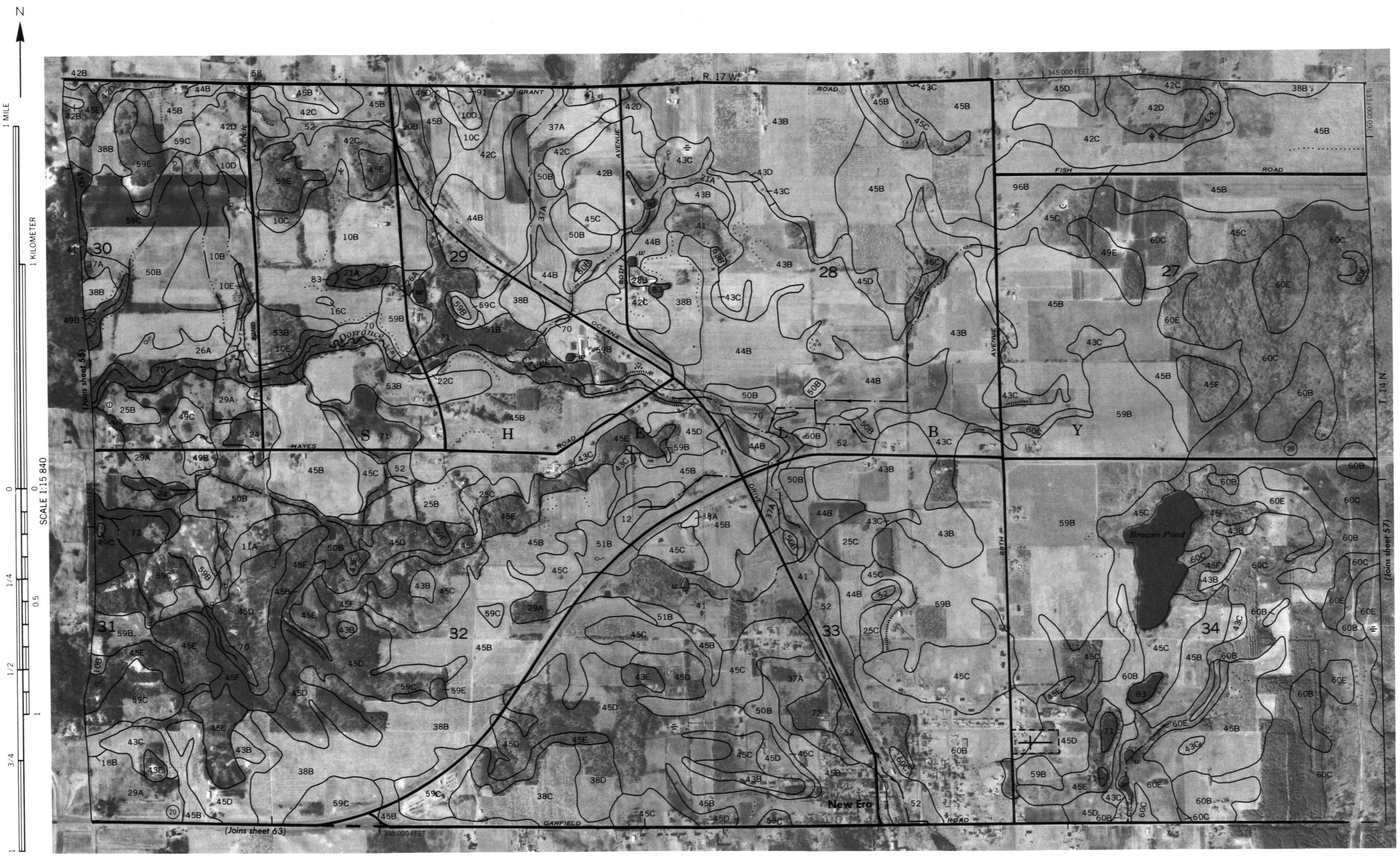


OCEANA COUNTY, MICHIGAN NO. 54

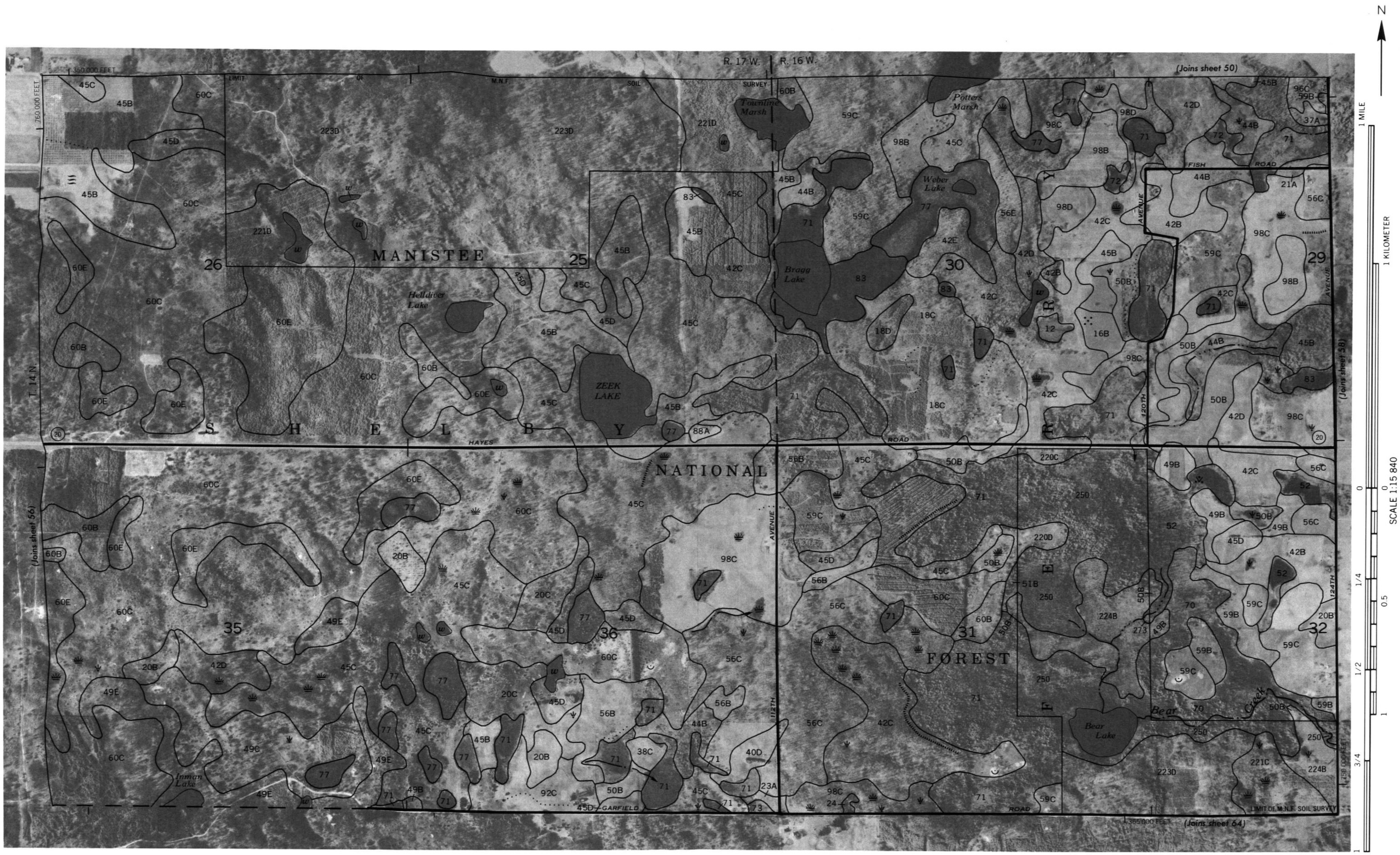
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 55



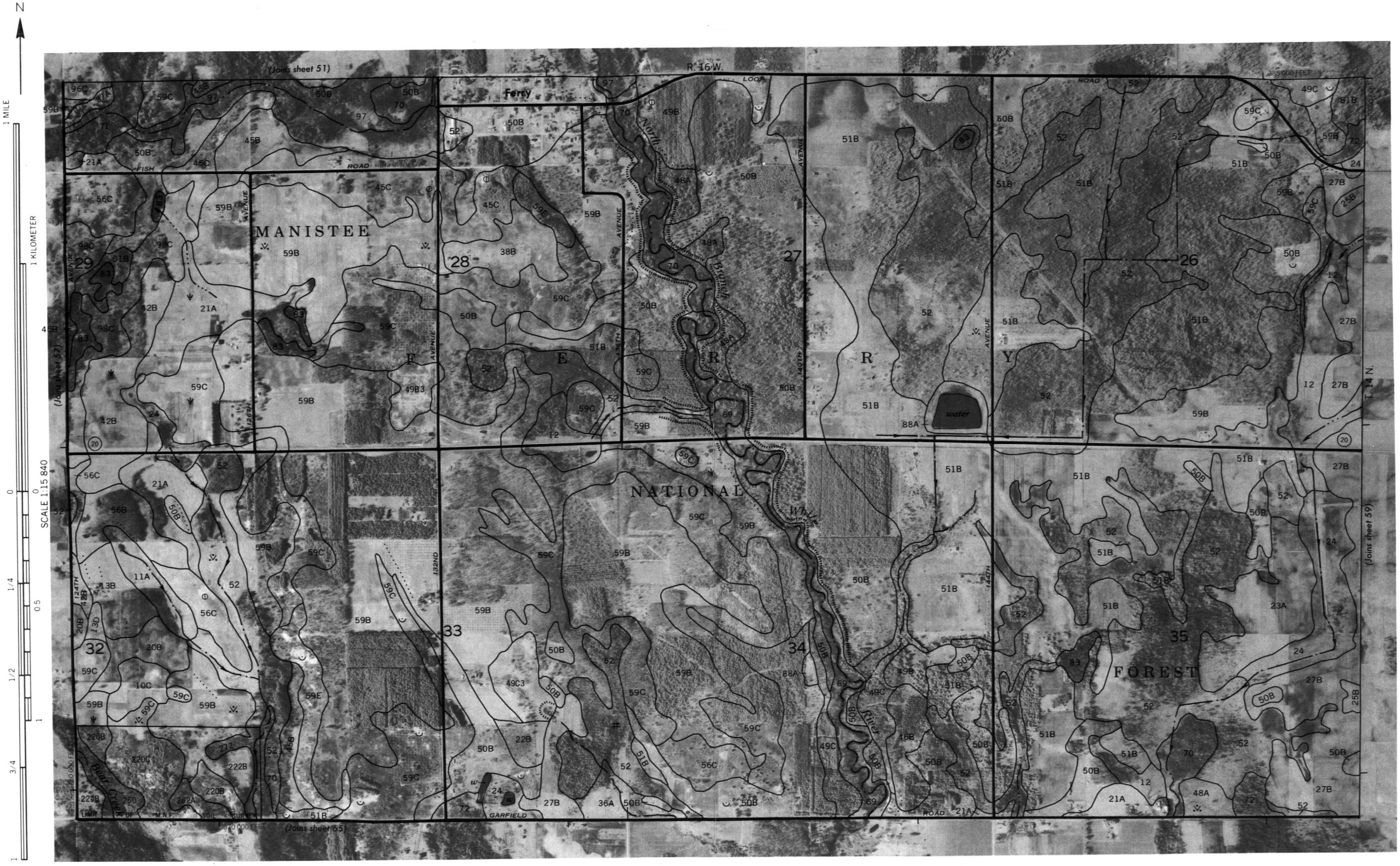
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 56



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 57

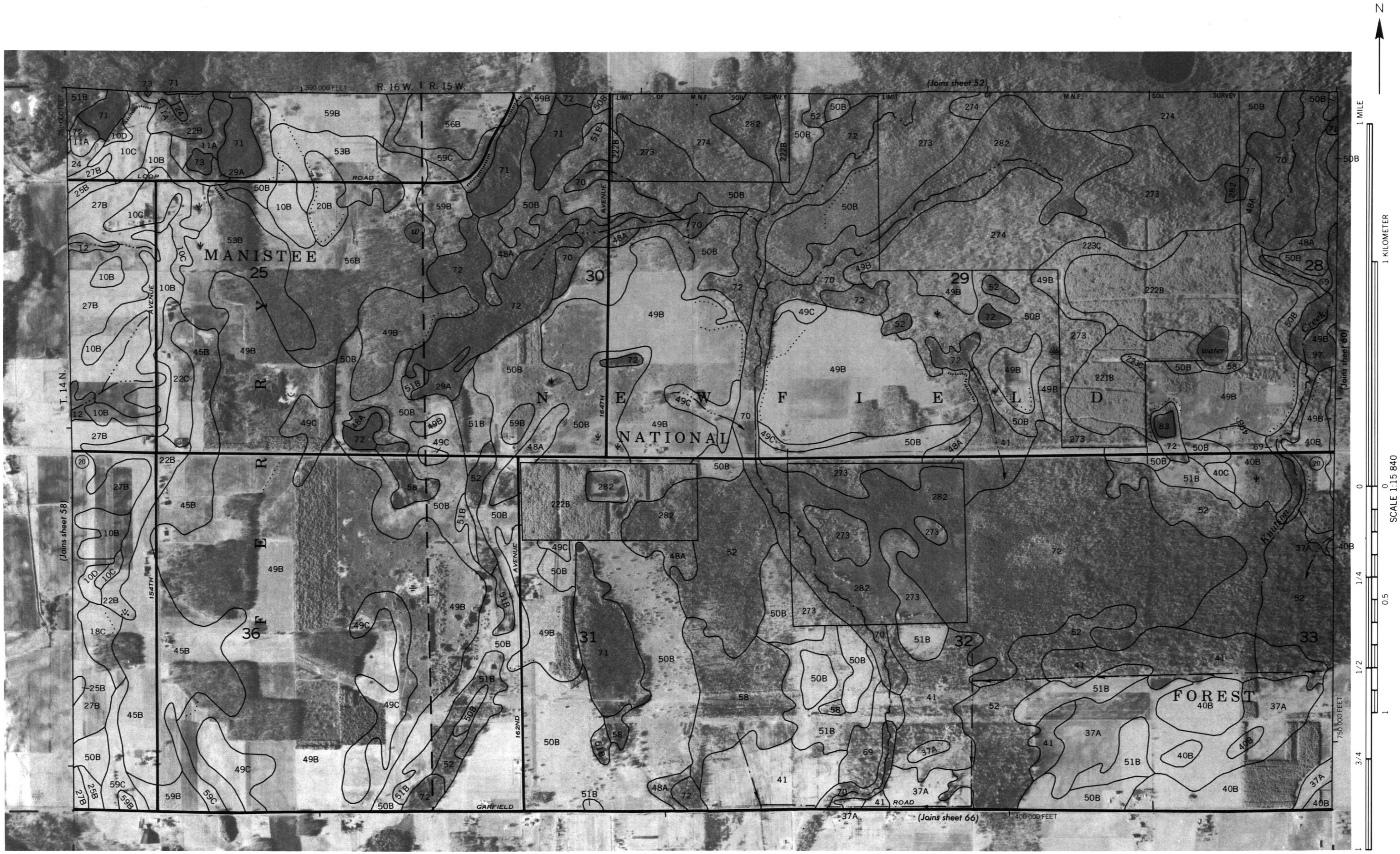


SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 58

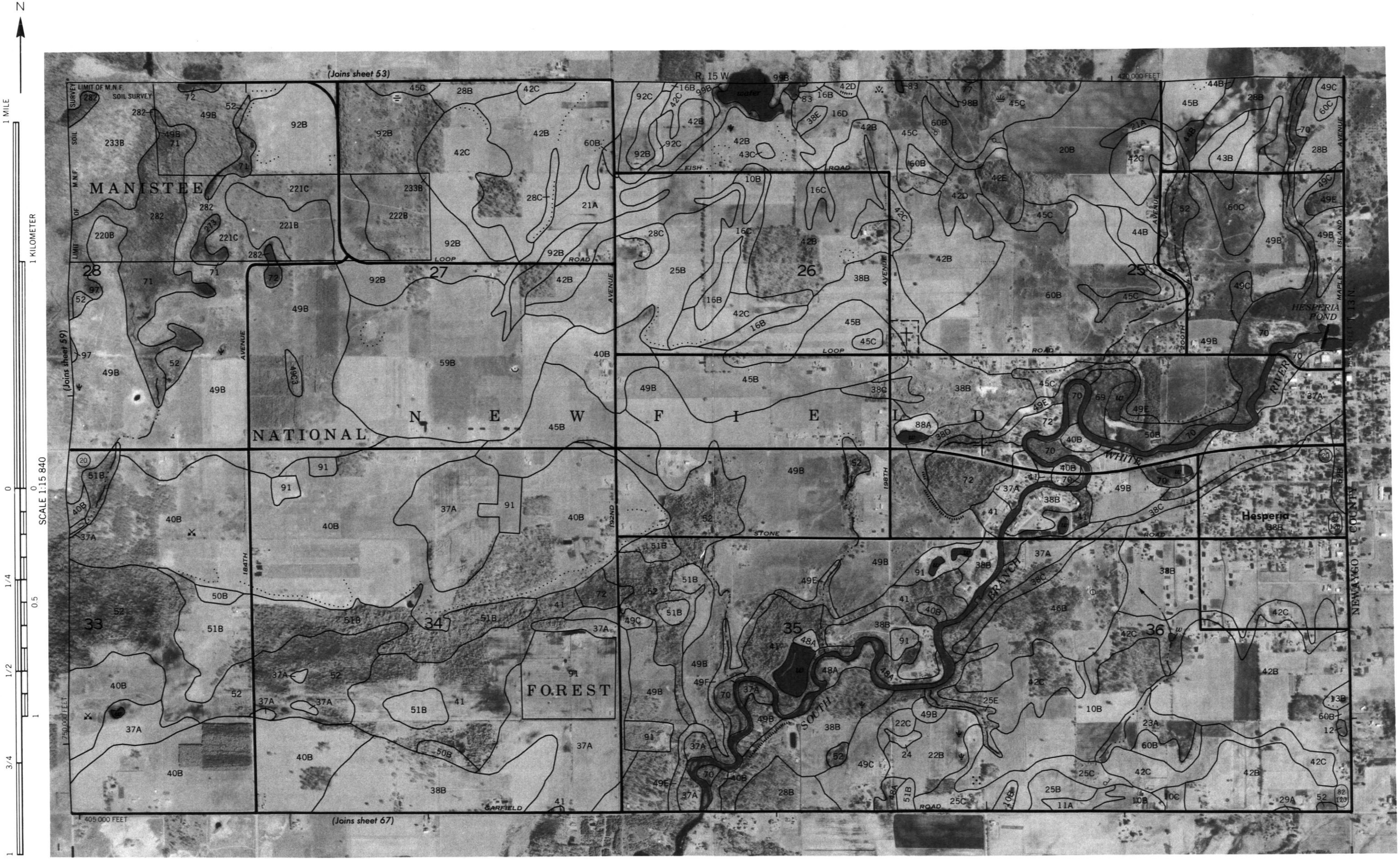


SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 59

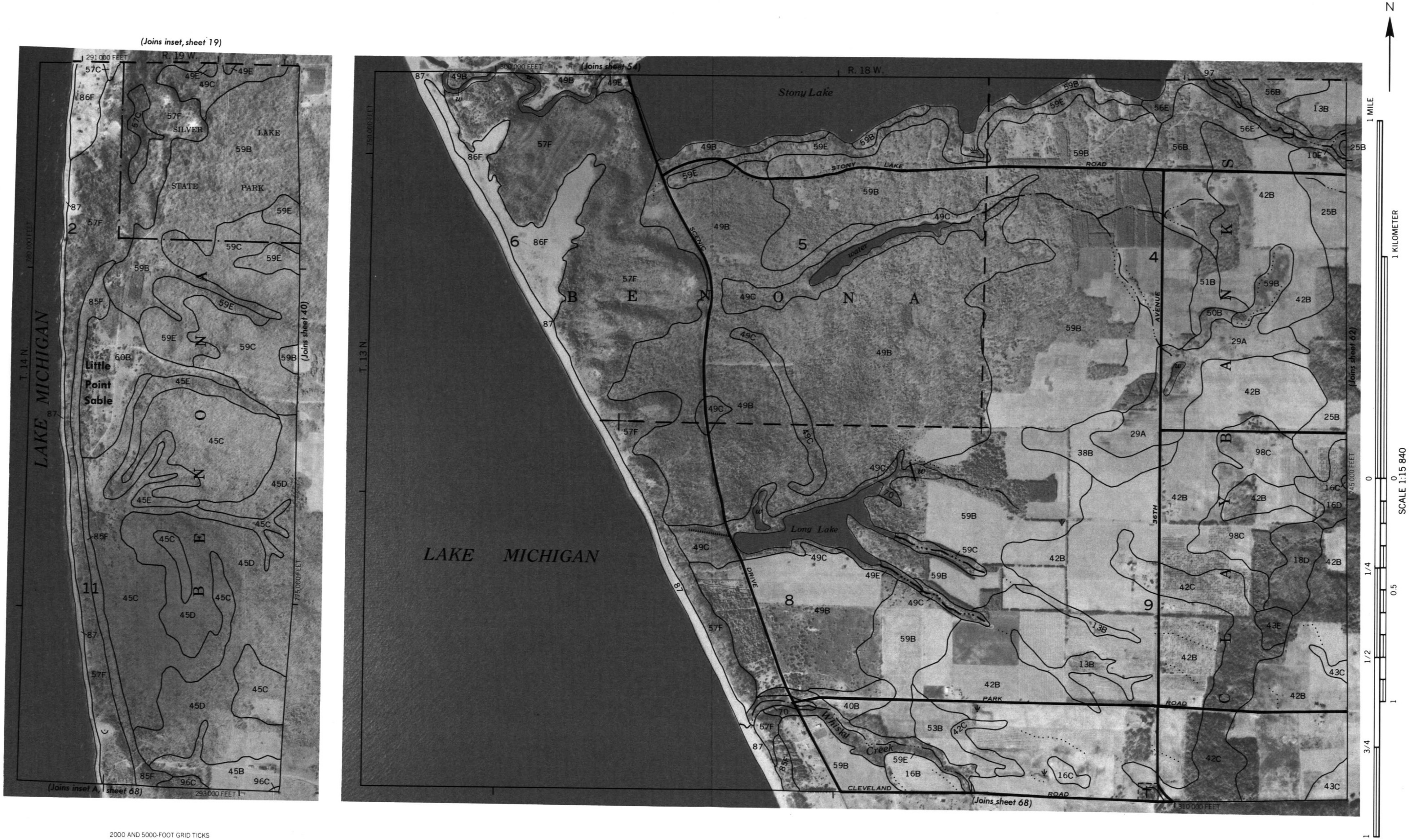
OCEANA COUNTY, MICHIGAN NO. 59



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 60

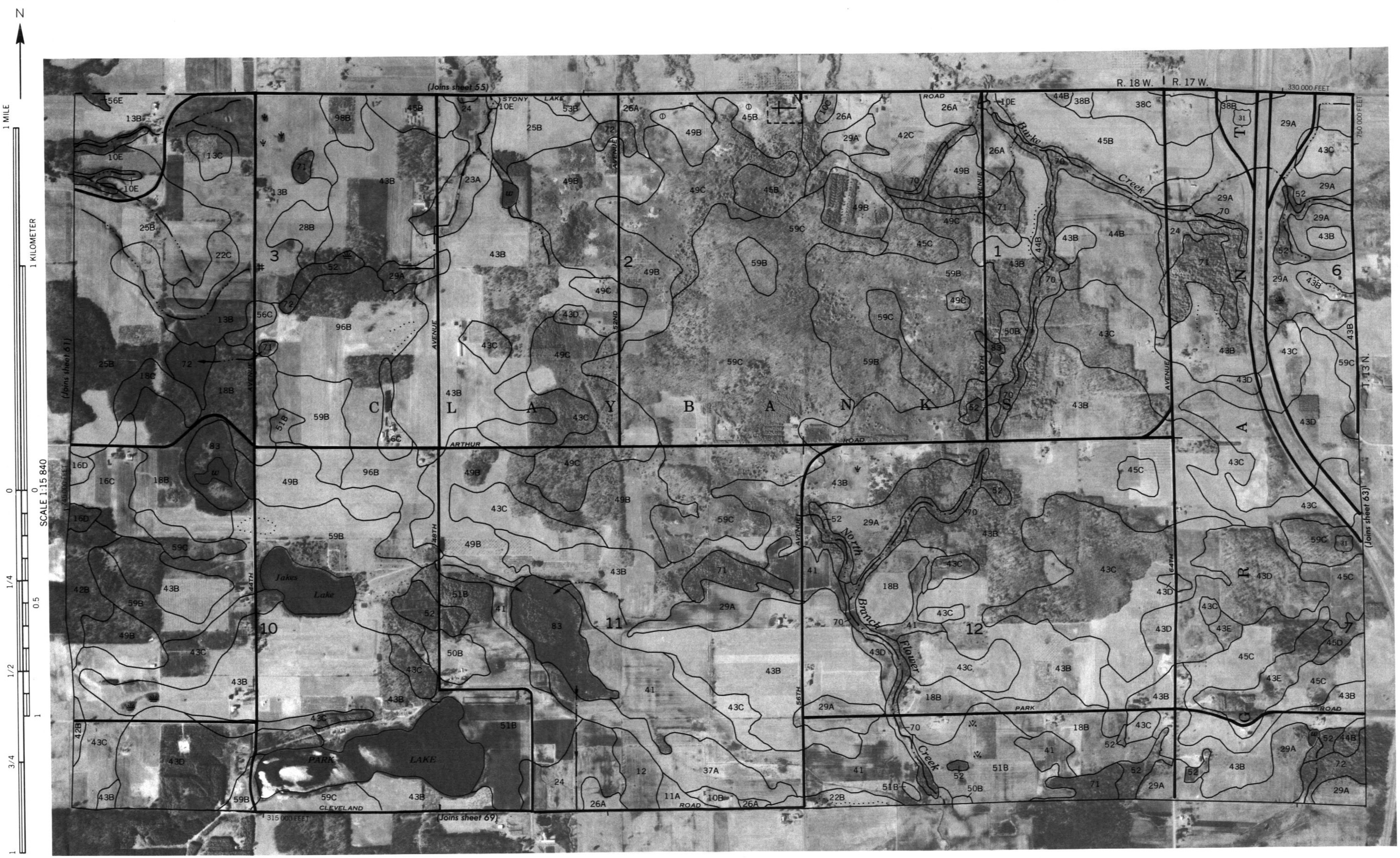


OCEANA COUNTY, MICHIGAN NO. 61



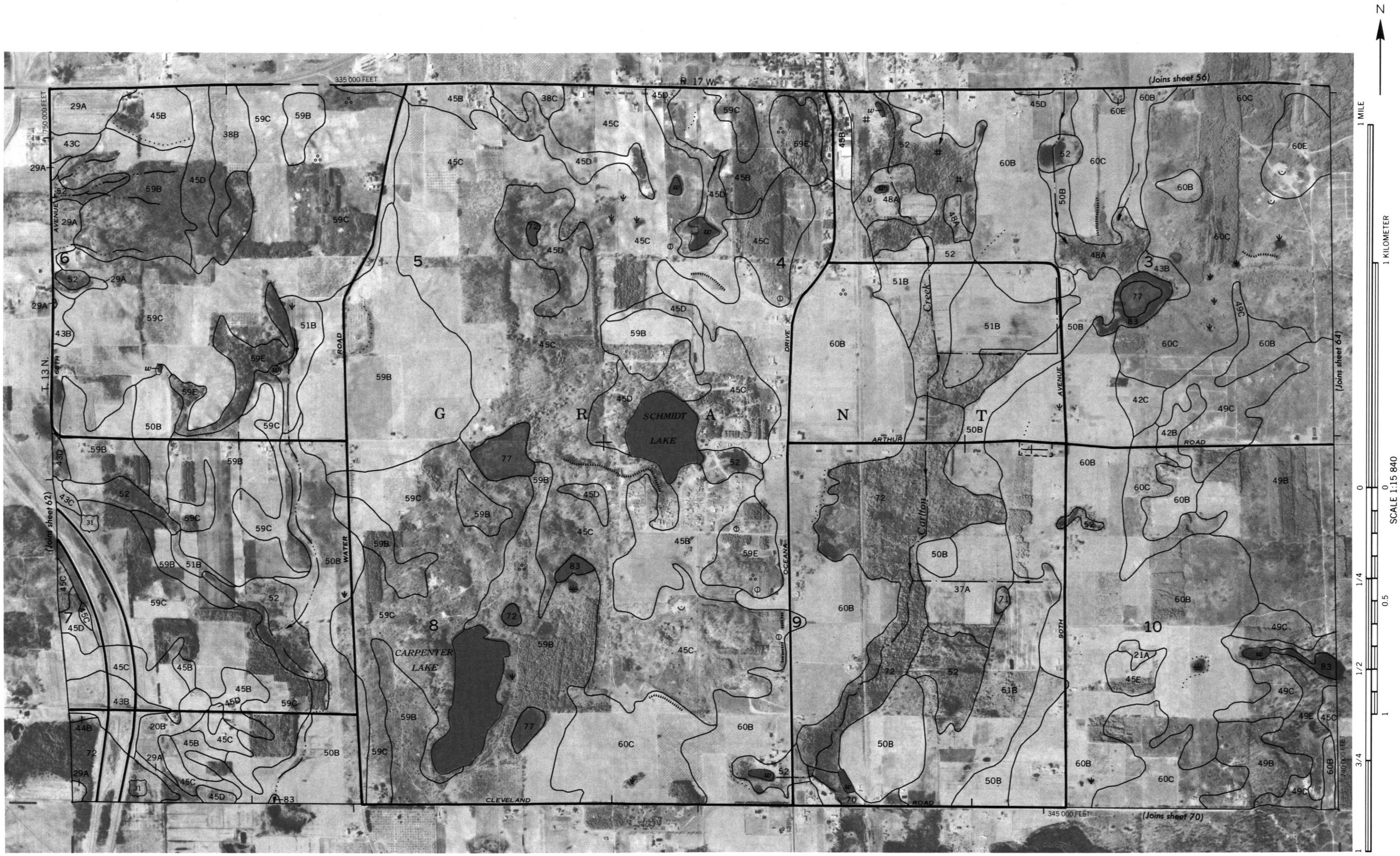
2000 AND 5000-FOOT GRID TICKS

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 62



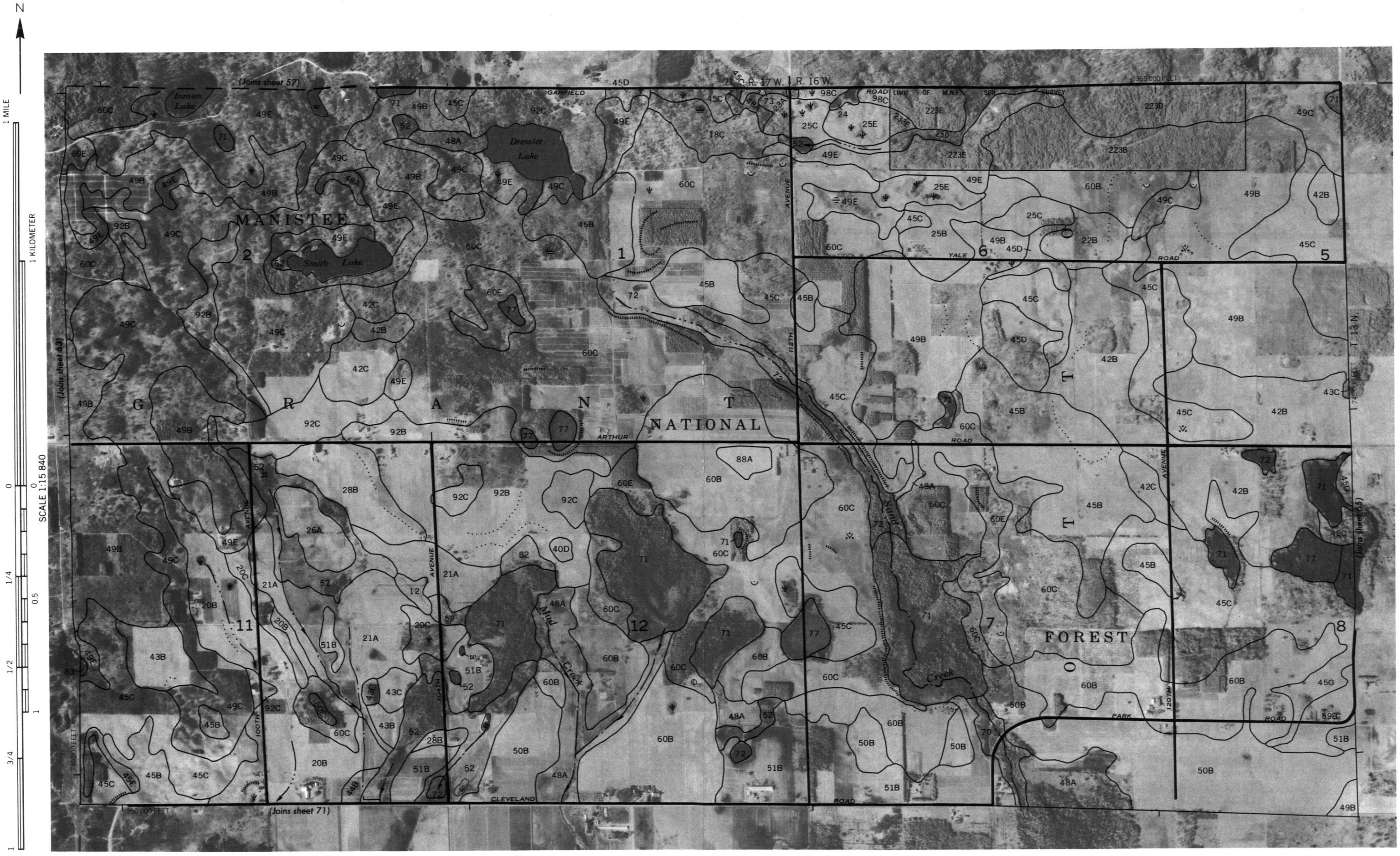
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 63

OCEANA COUNTY, MICHIGAN NO. 63



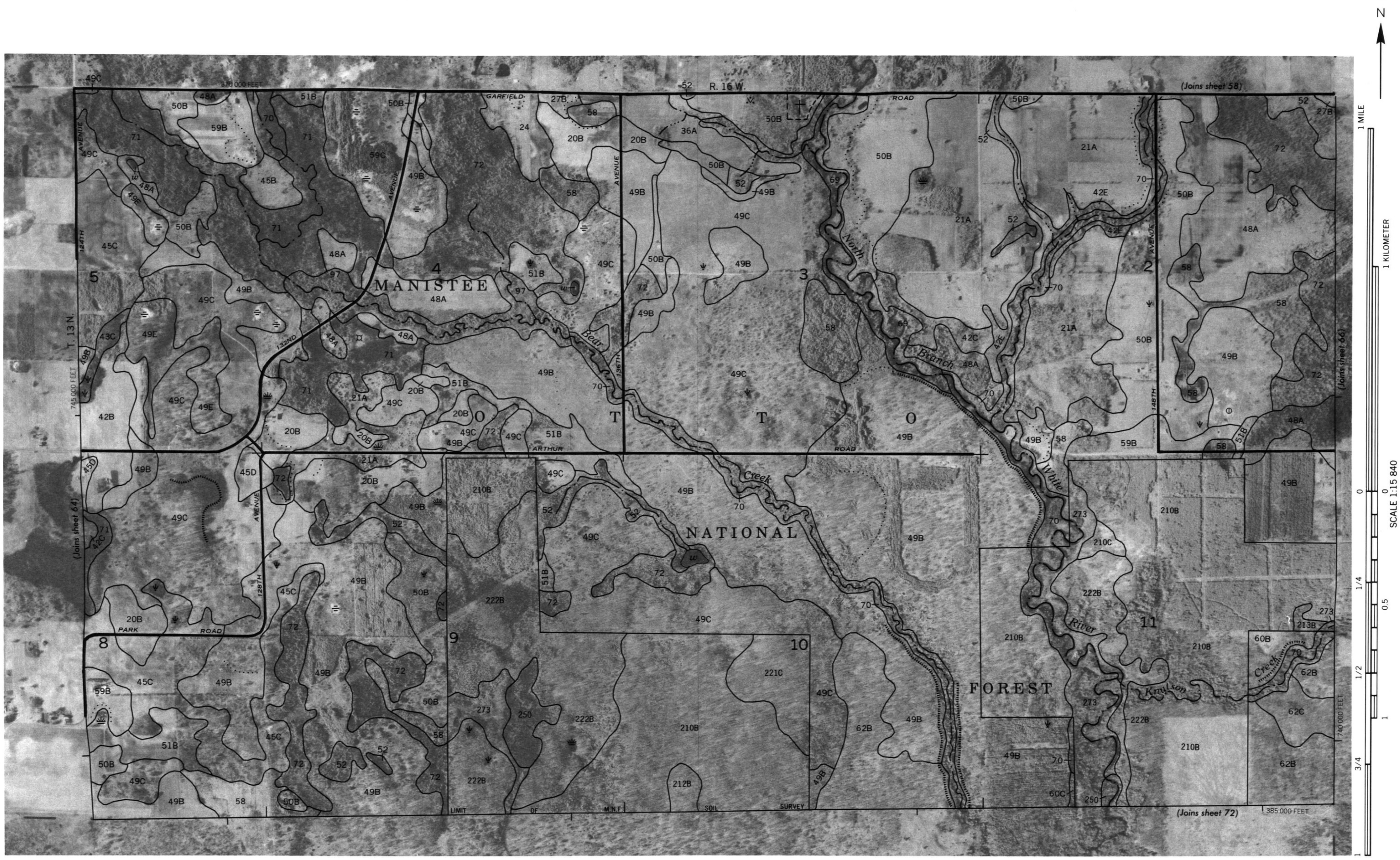
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 64

(64)



OCEANA COUNTY, MICHIGAN NO. 64

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 65



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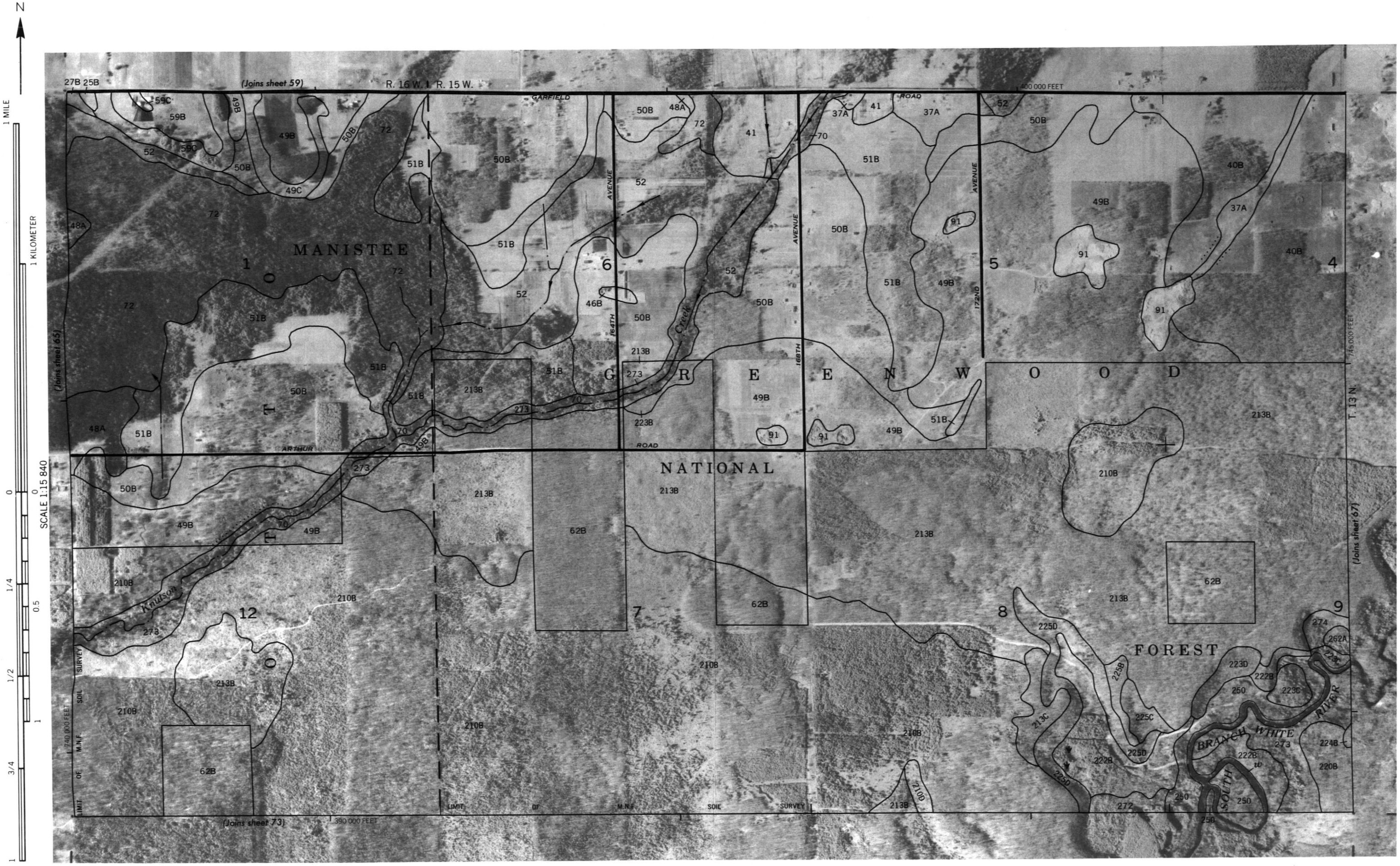
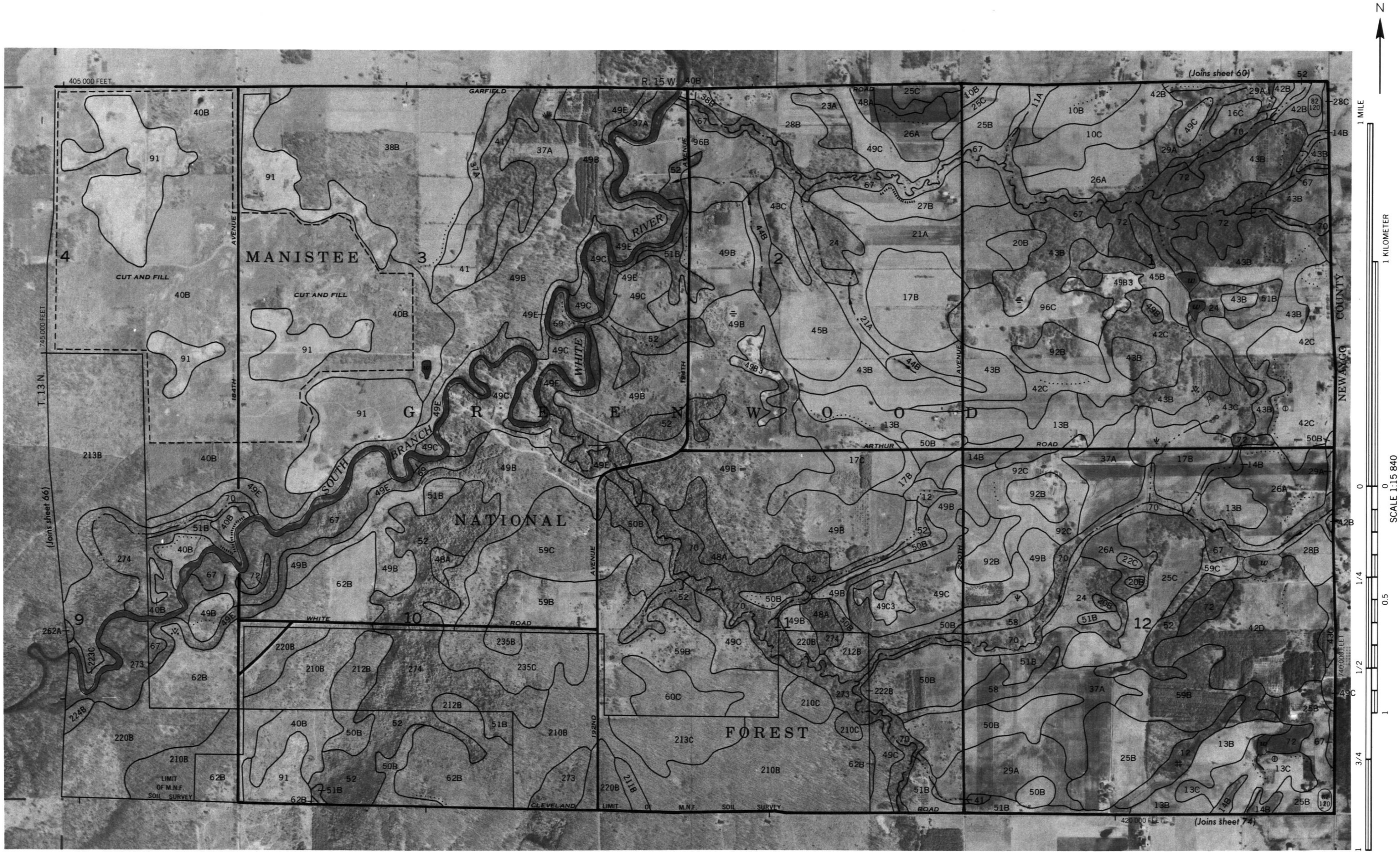
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 66



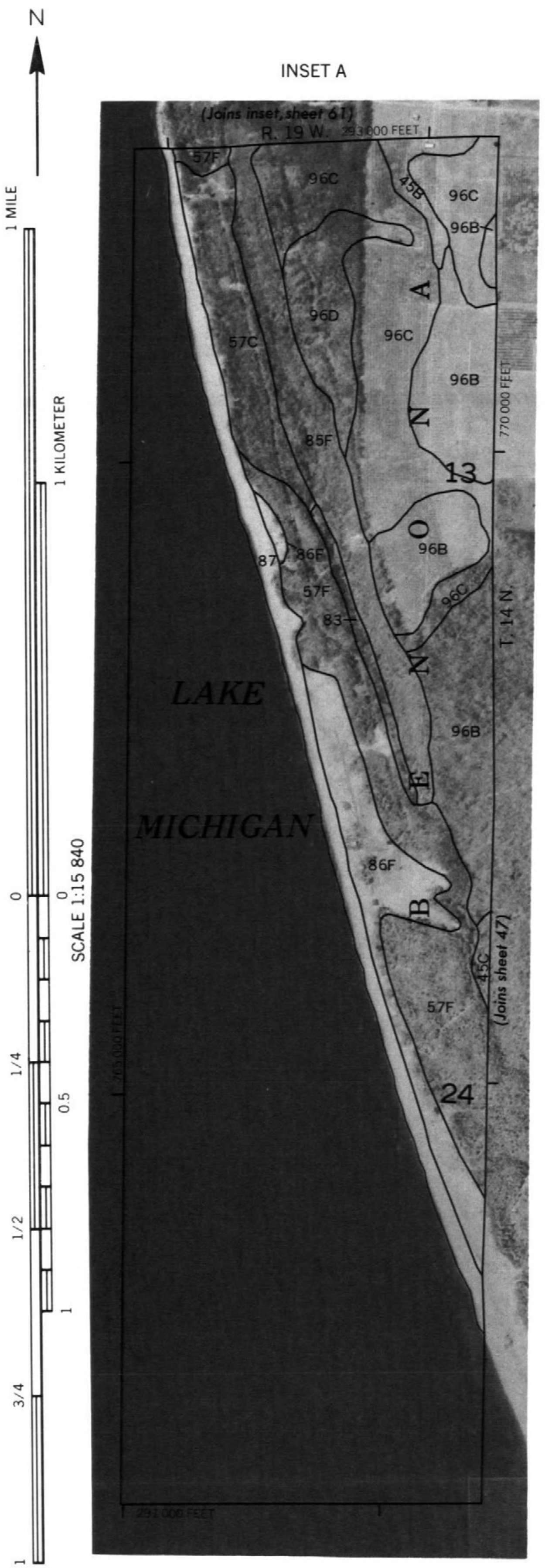
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 67

OCEANA COUNTY, MICHIGAN NO. 67



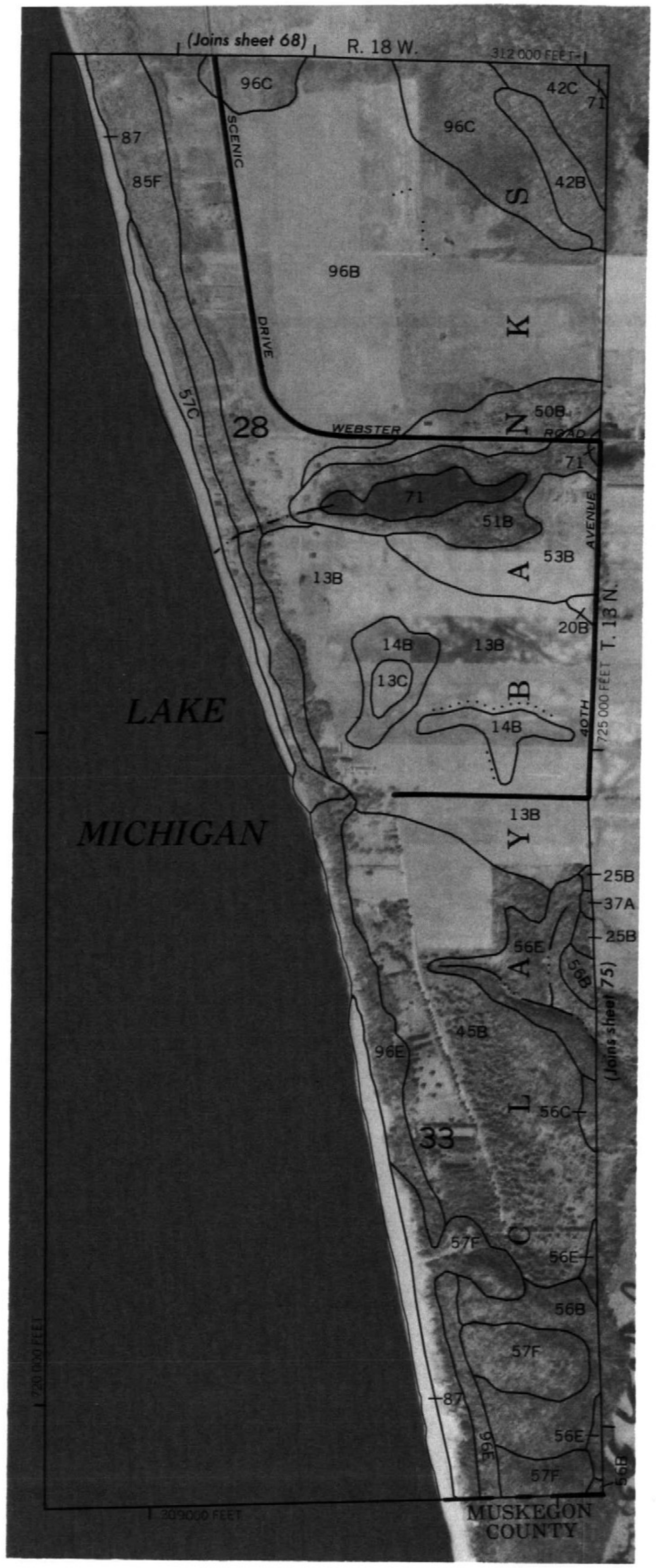
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 68

INSET A

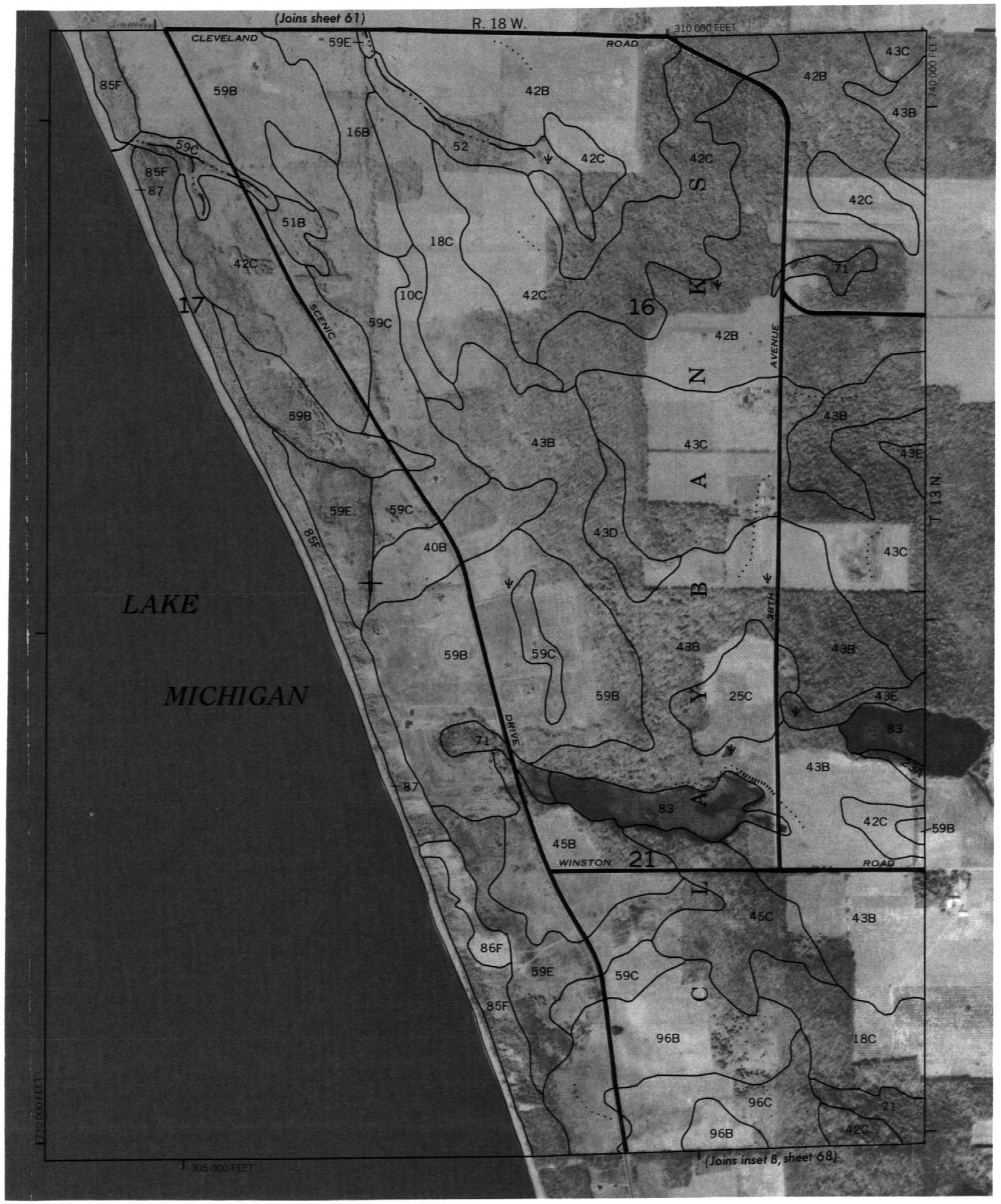


2000 AND 5000-FOOT GRID TICKS

INSET B



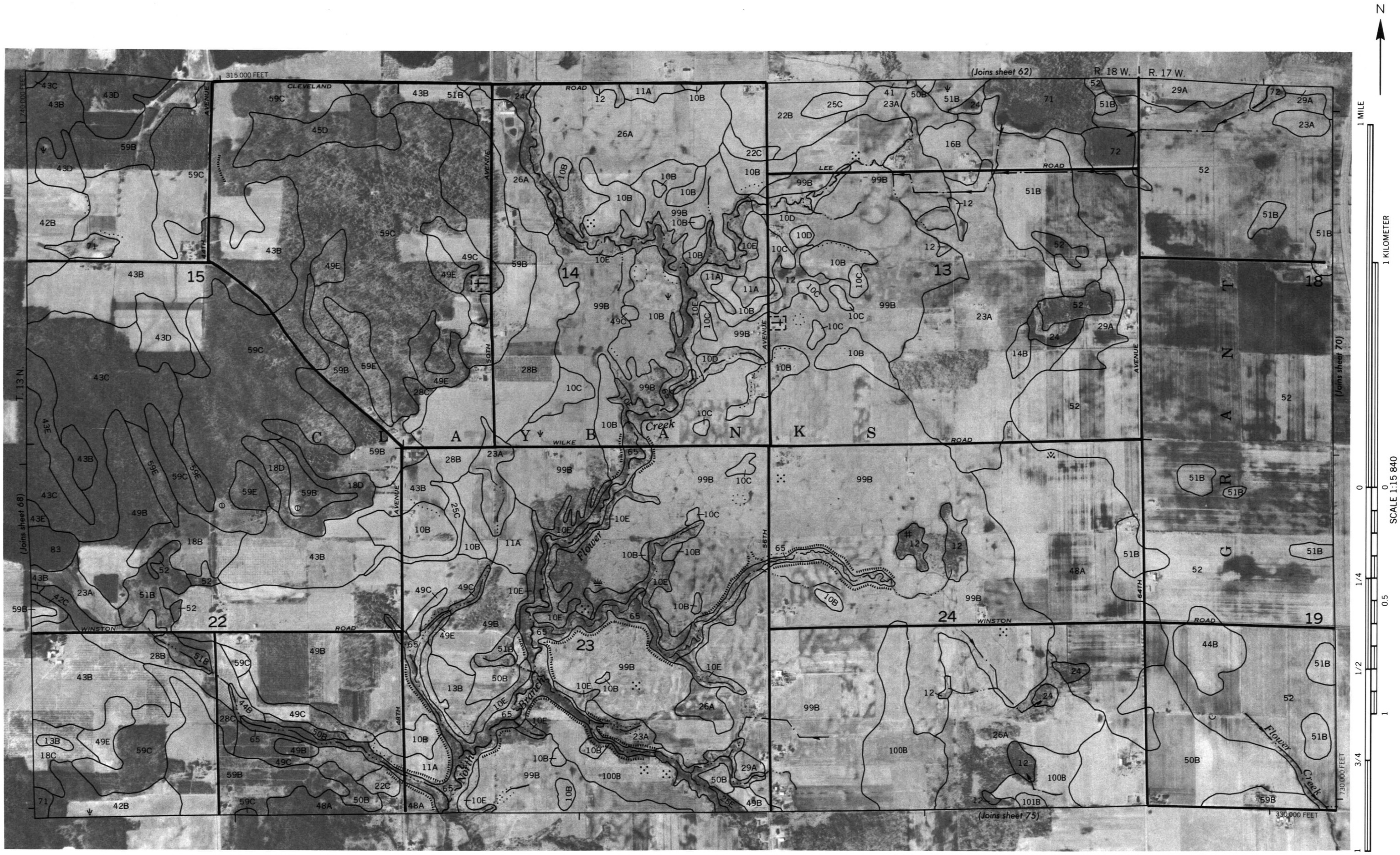
3000 AND 5000-FOOT GRID TICKS



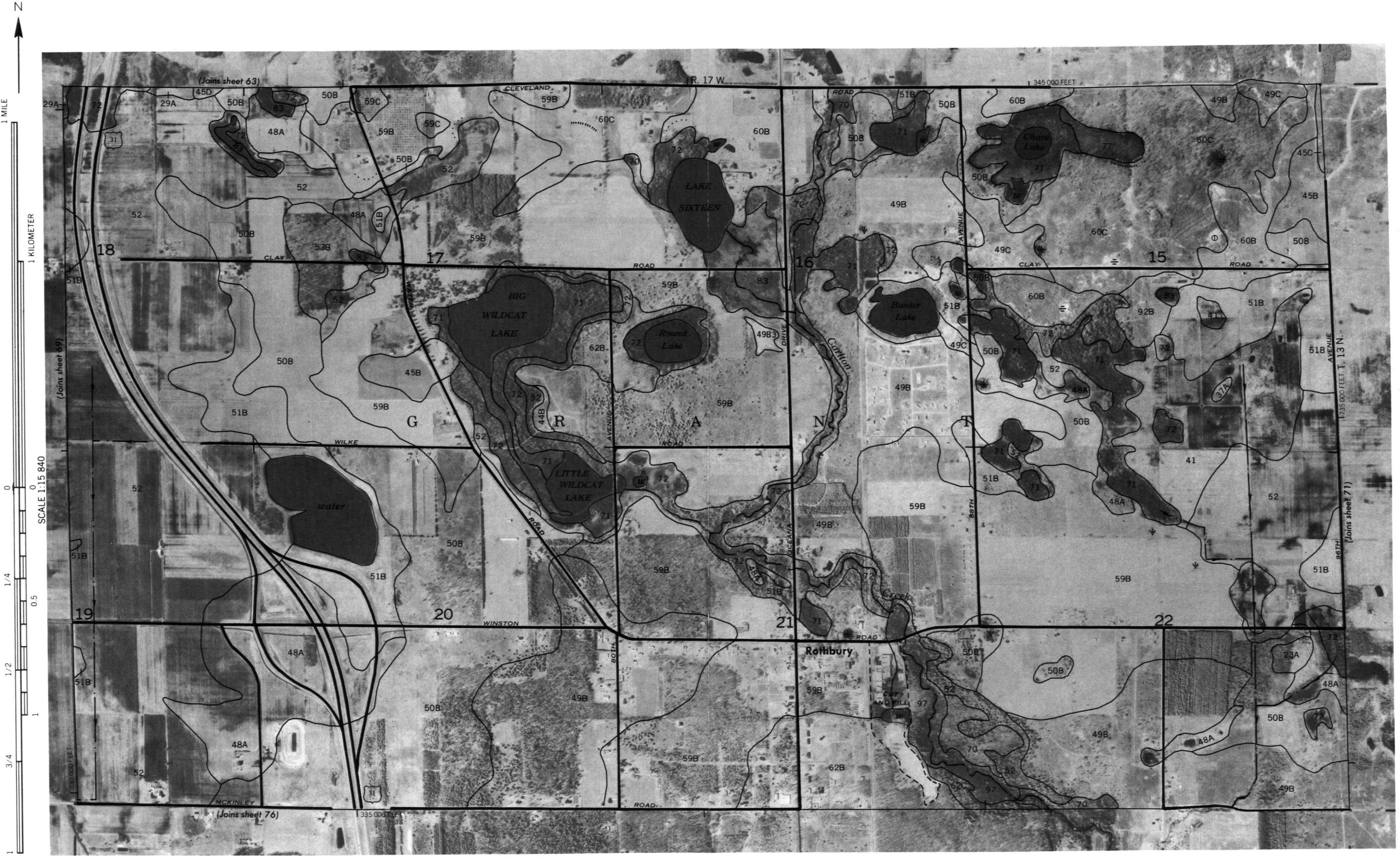
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 69

(69)

OCEANA COUNTY, MICHIGAN NO. 69

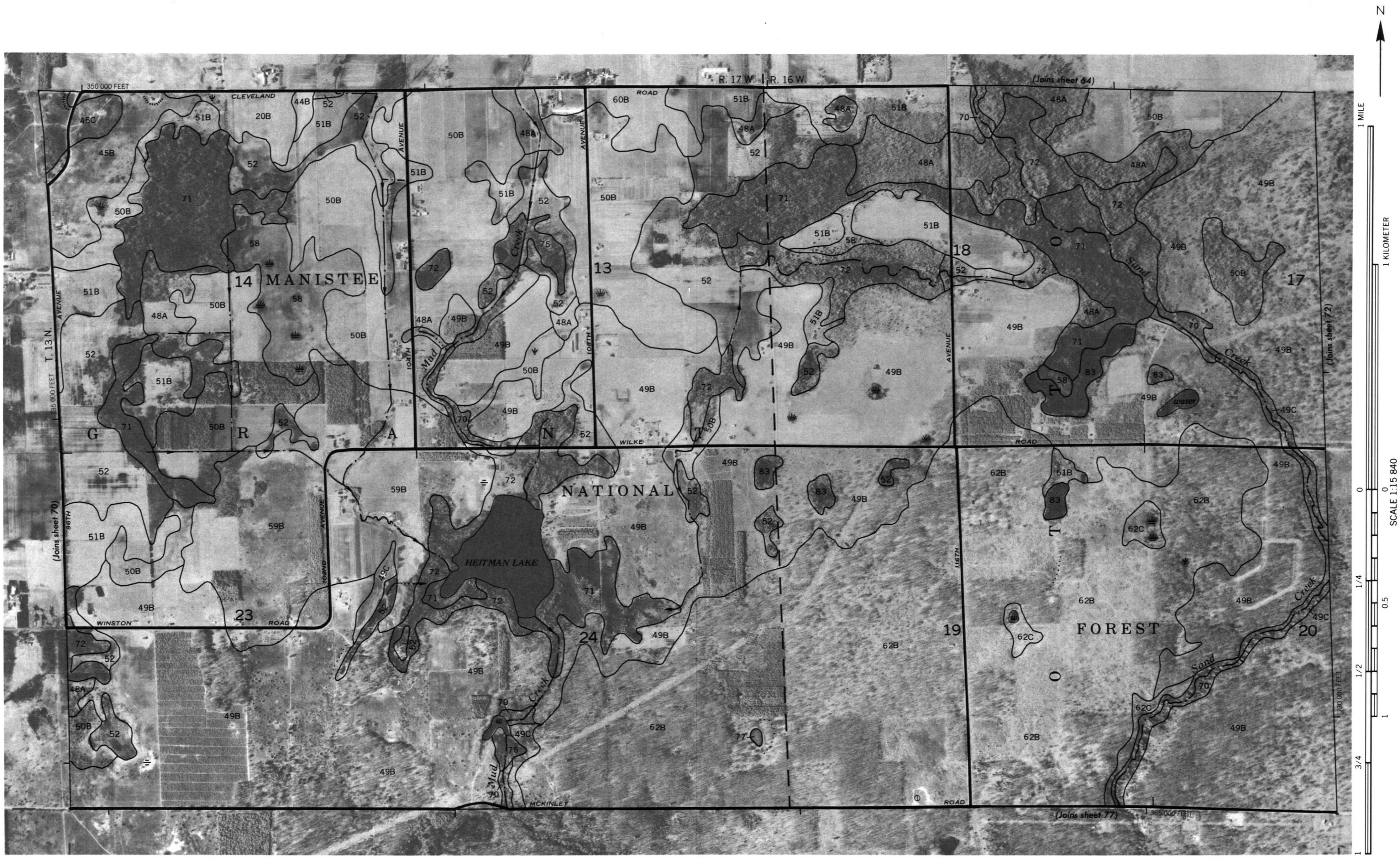


SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 70



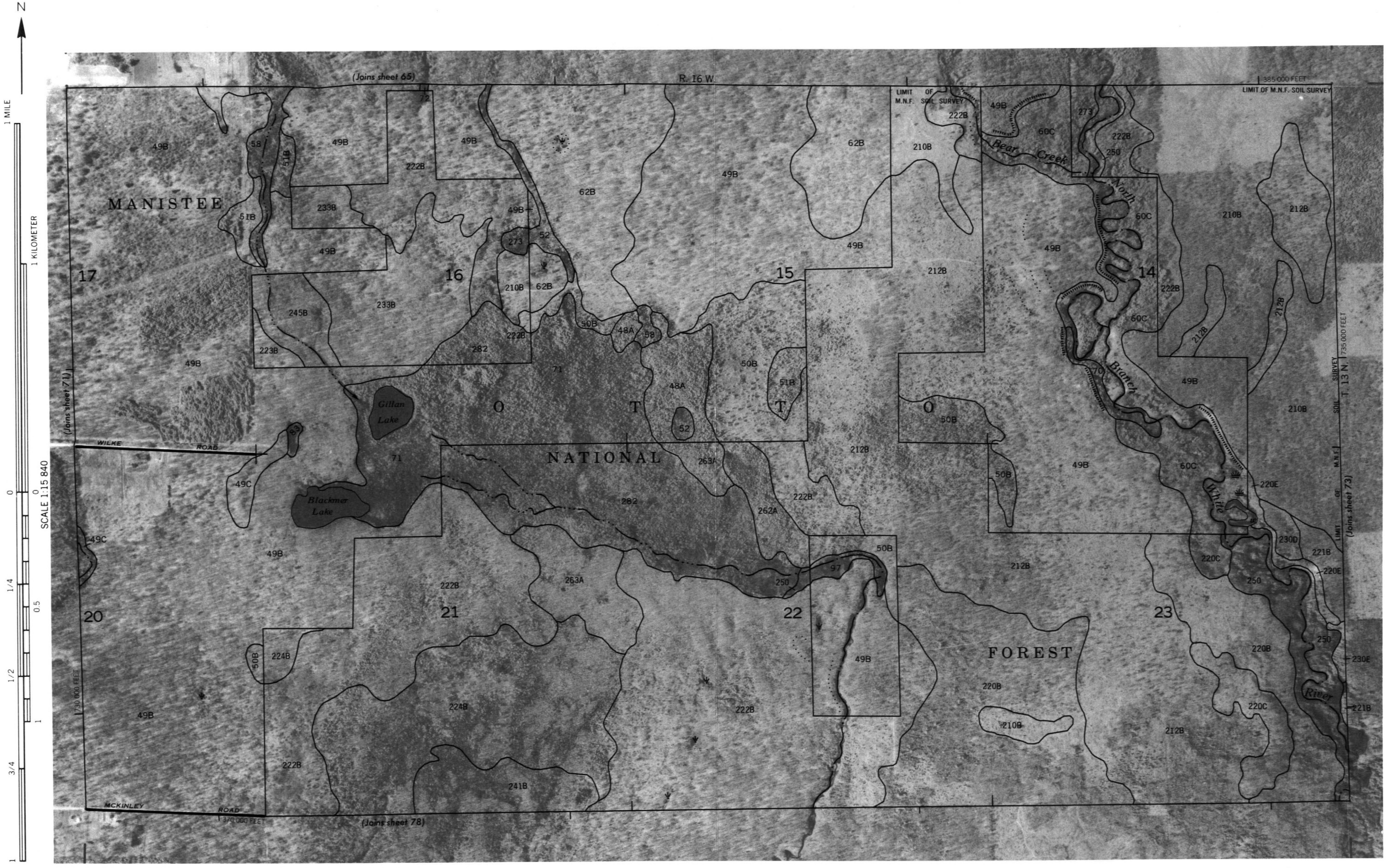
OCEANA COUNTY, MICHIGAN NO. 70

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 71



OCEANA COUNTY, MICHIGAN NO. 71

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 72



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 73

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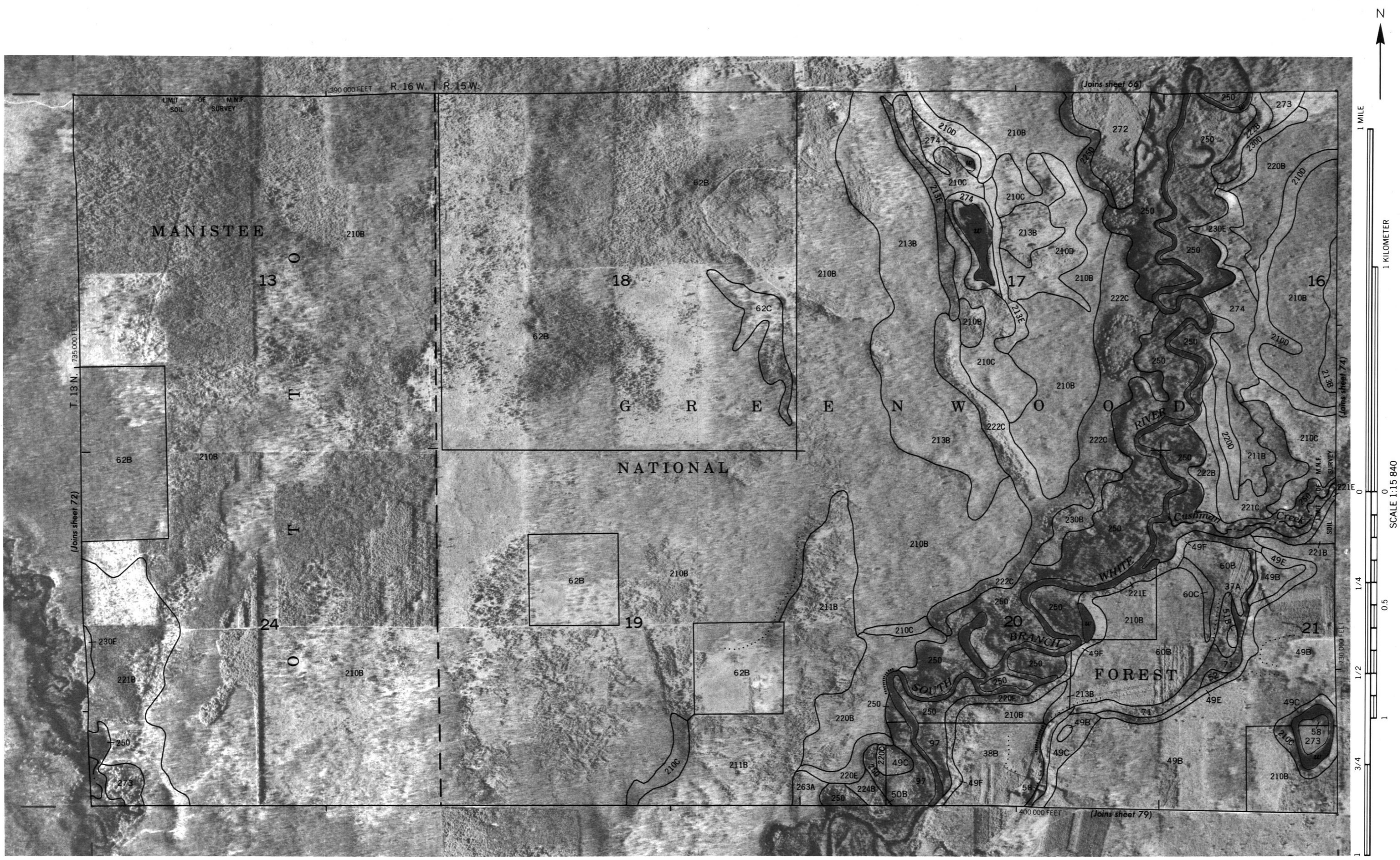
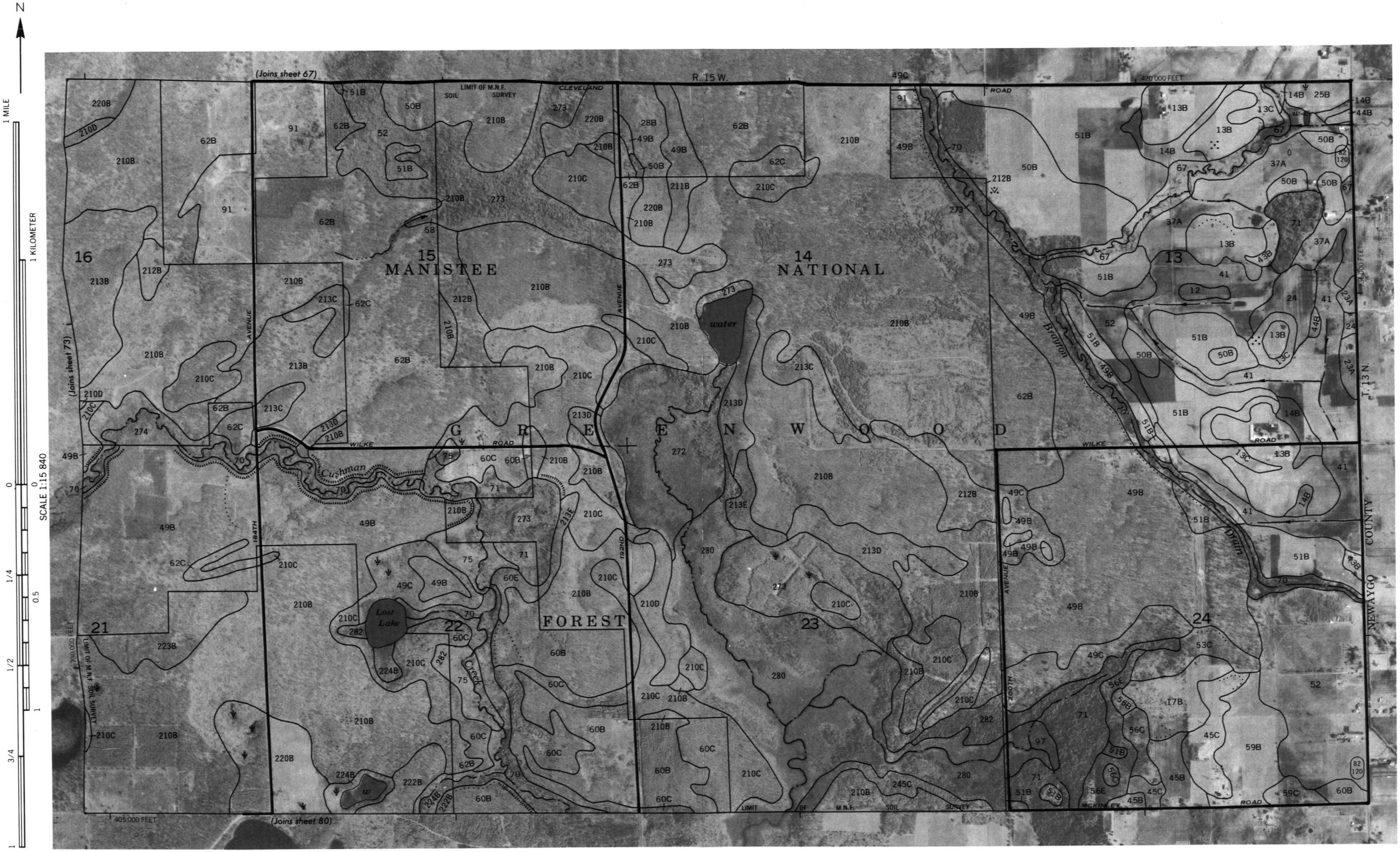
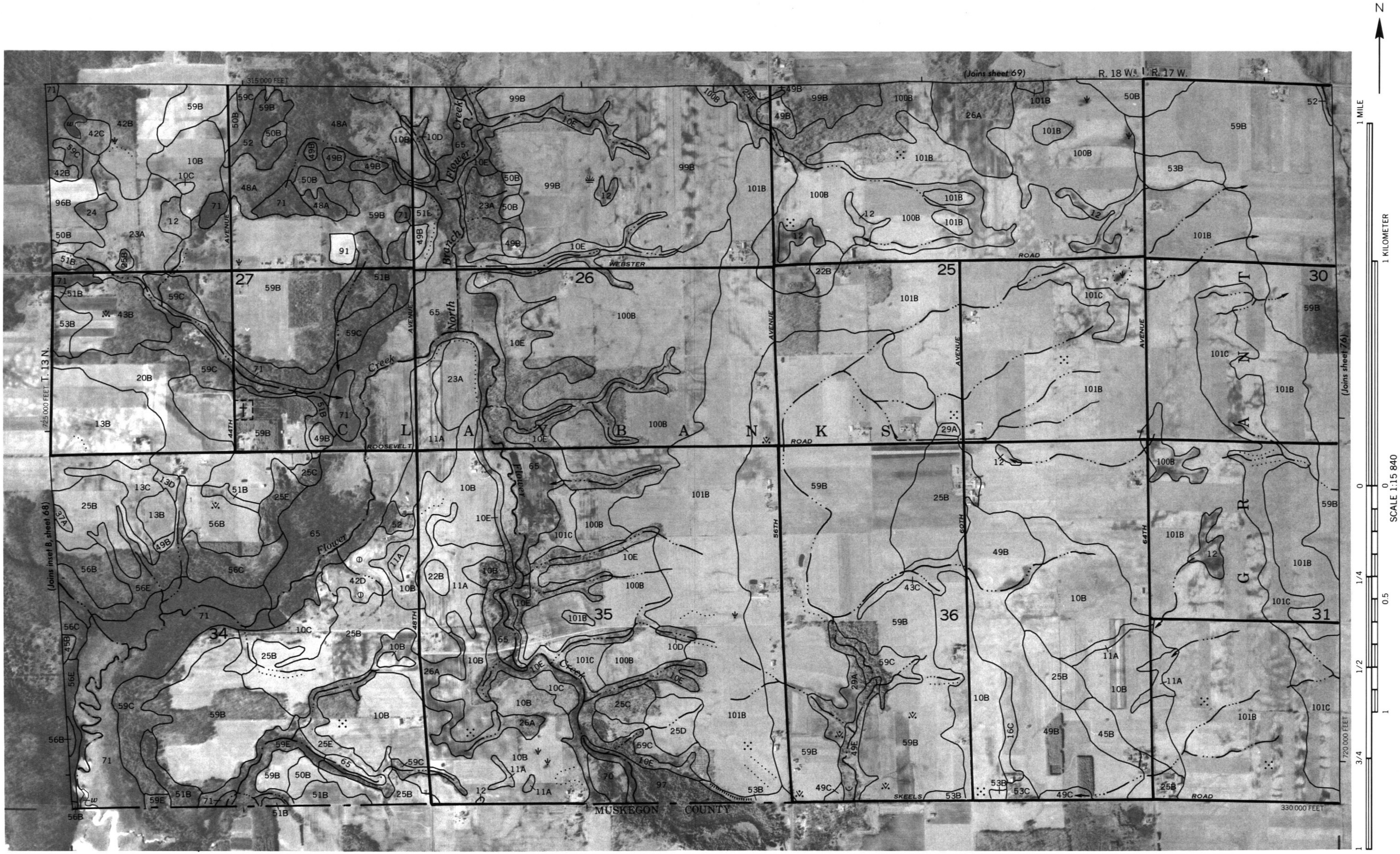
OCEANA COUNTY, MICHIGAN NO. 73



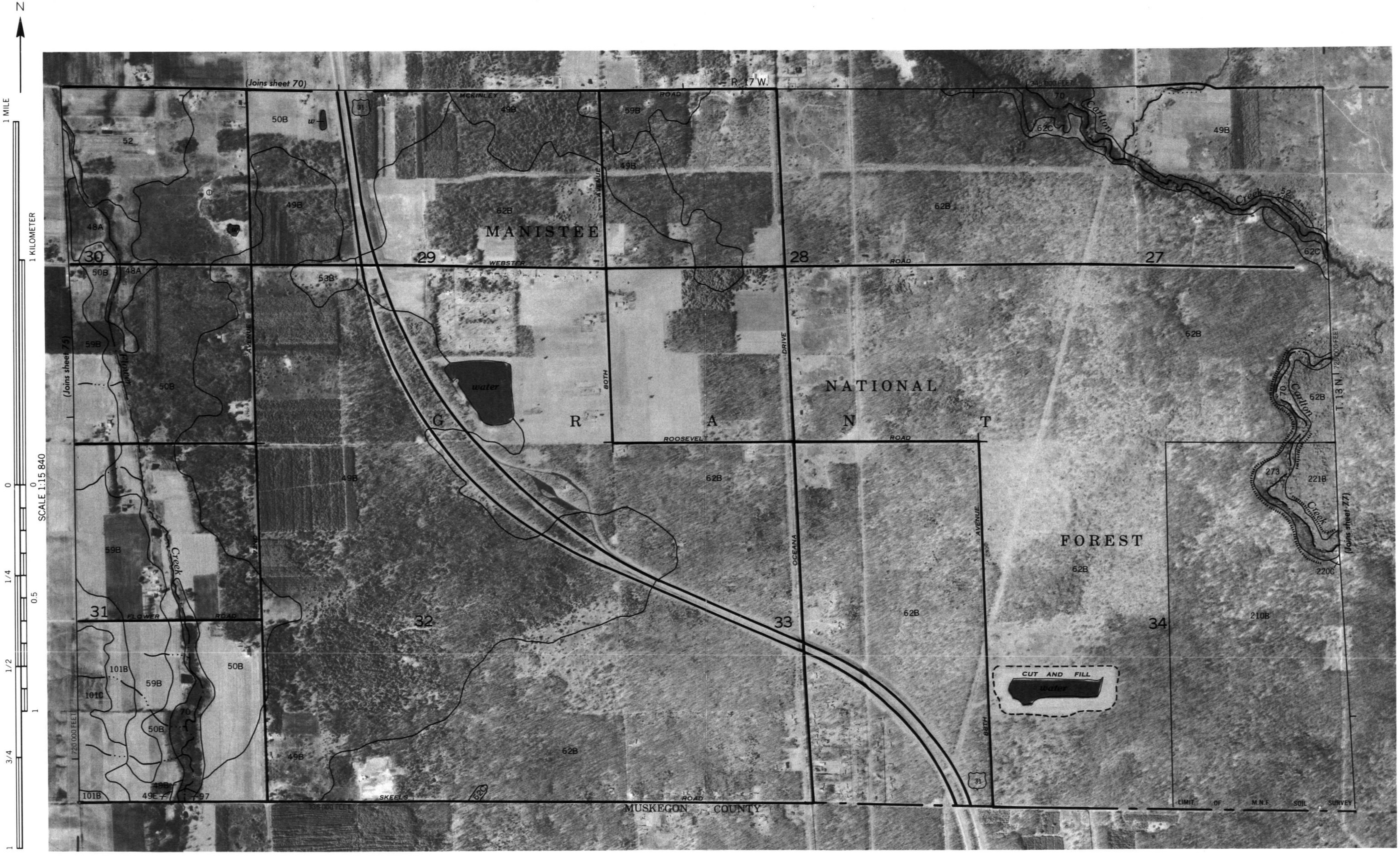
SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 74

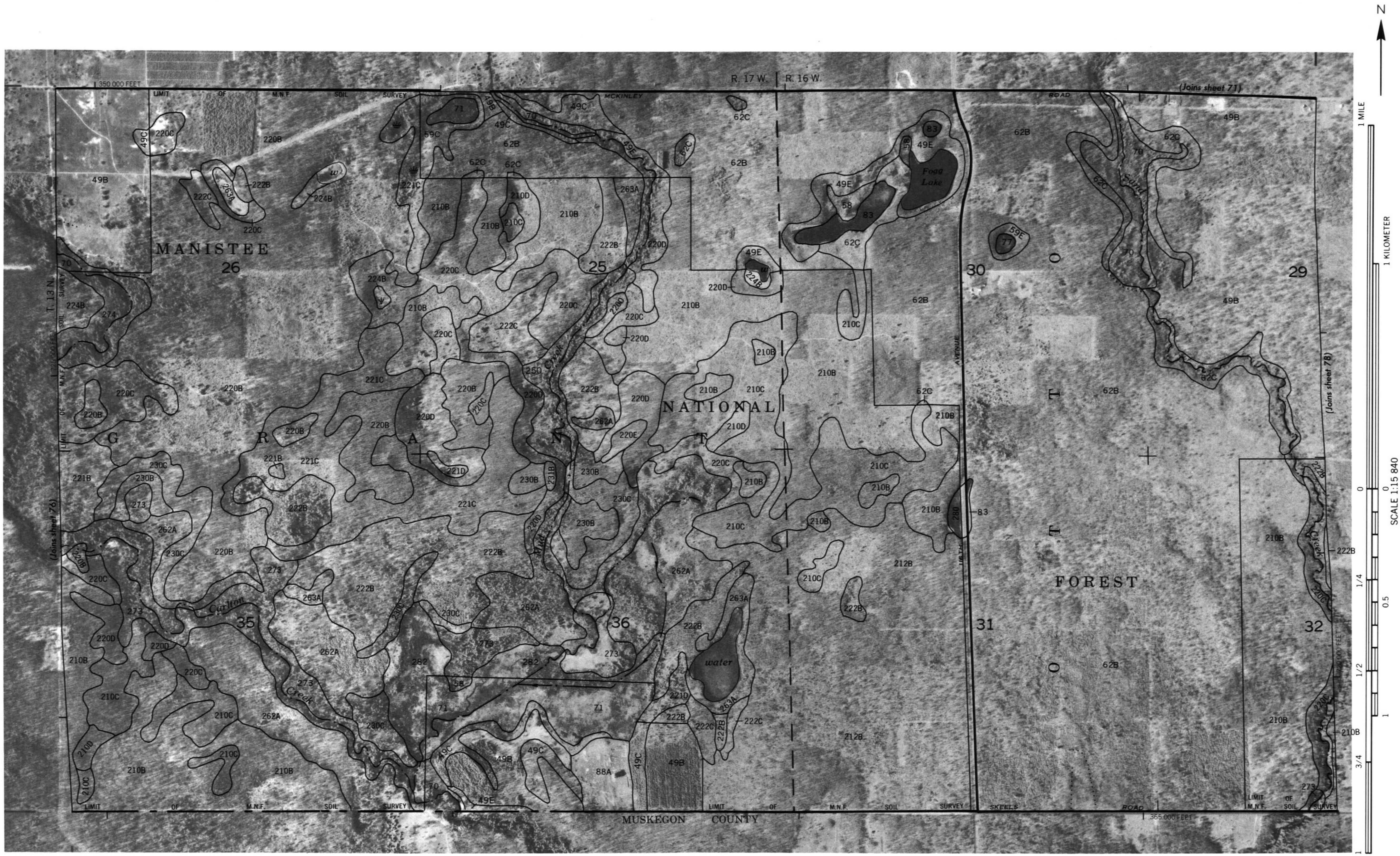


OCEANA COUNTY, MICHIGAN NO. 75



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 76

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LIMIT OF M.N.F. SOIL SURVEY
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AVENUE
MUSKEGON COUNTY
MANISTEE NATIONAL FOREST
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Mud Creek
Carlton Creek
Sand Creek
Foag Lake
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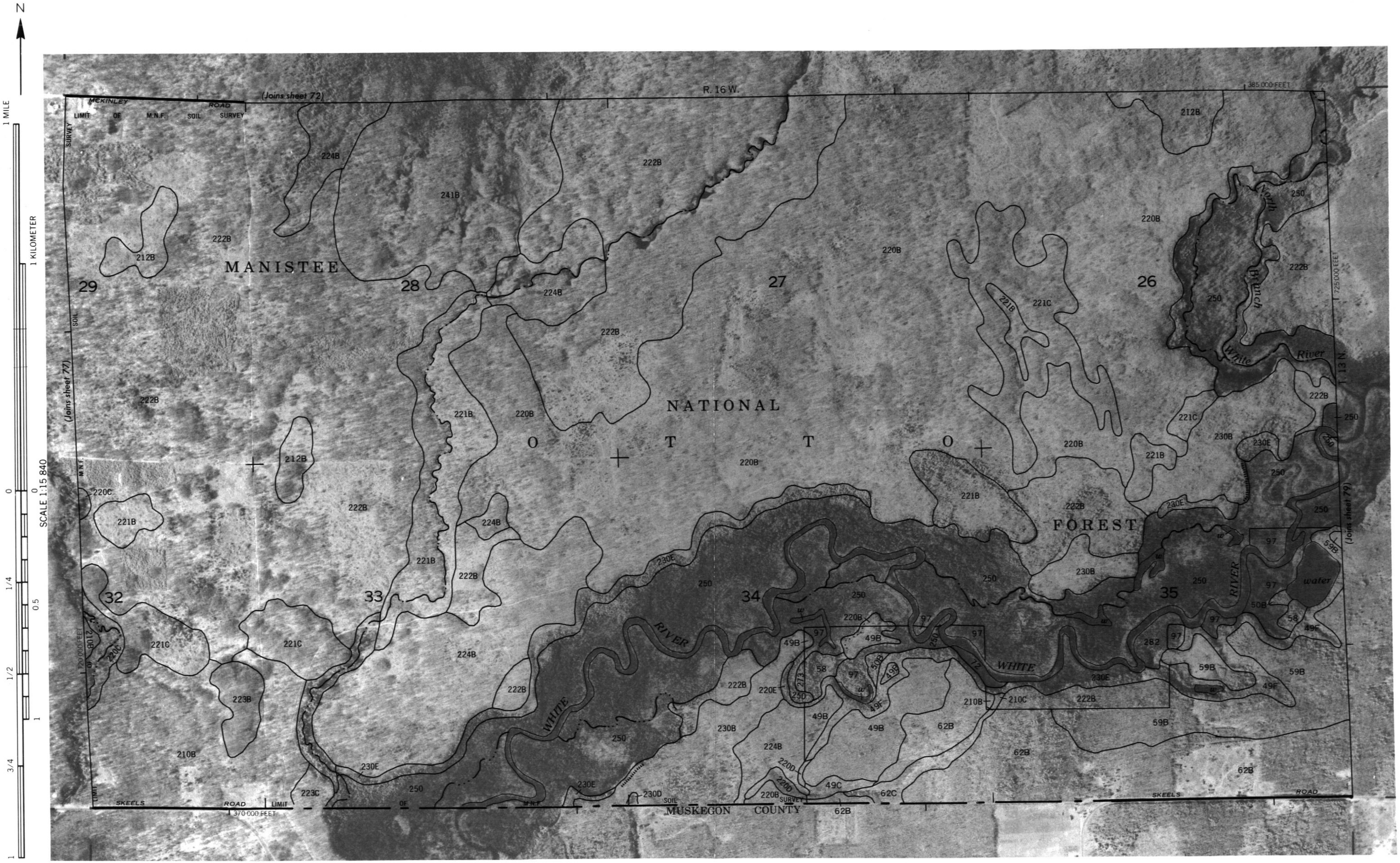
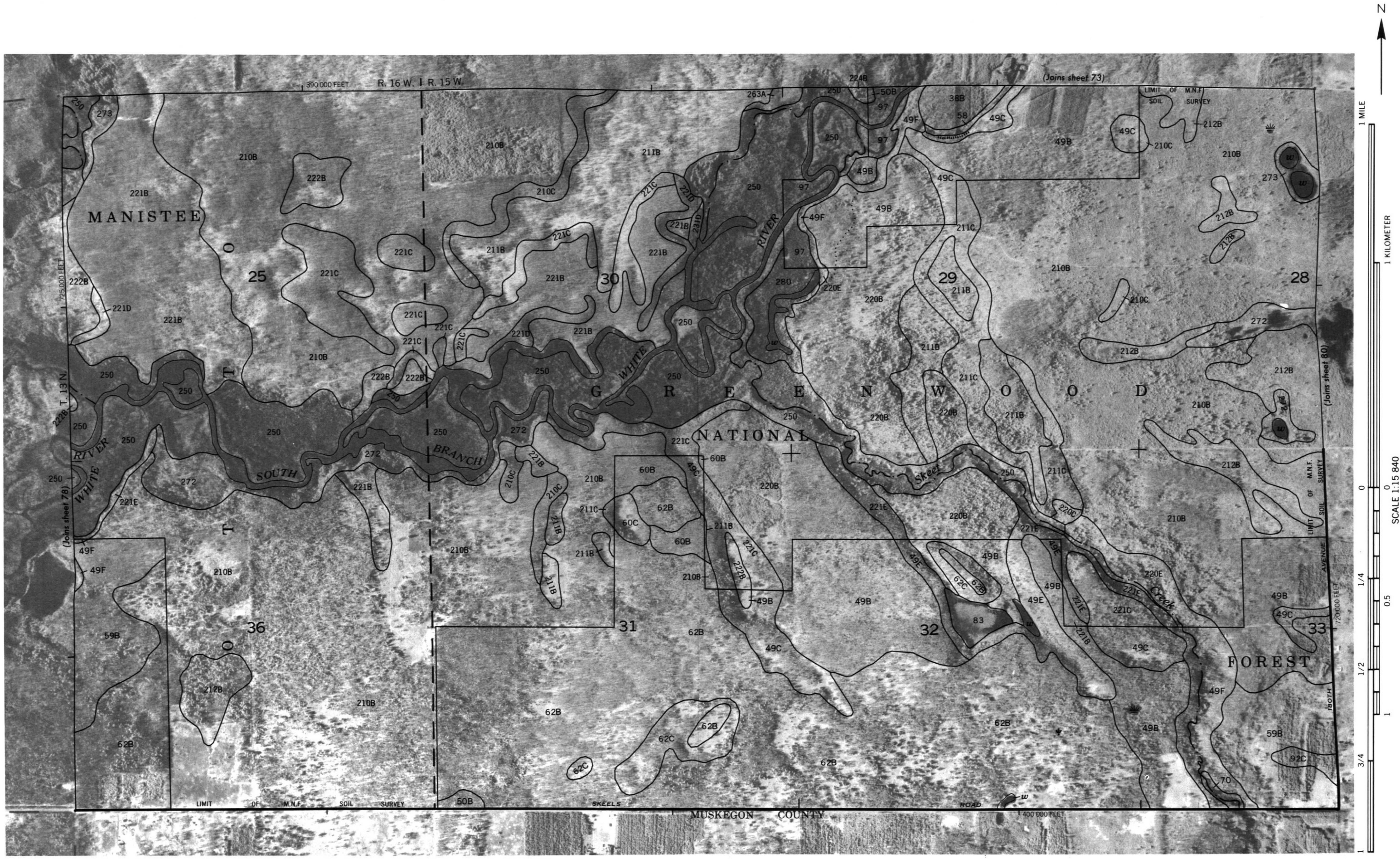
49C
49E
58
59C
59E
62B
62C
70
71
77
83
88A
210B
210C
210D
212B
220B
220C
220D
220E
221B
221C
221D
222B
222C
224B
230B
230C
231B
250
262A
263A
273
274
280
282
w

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 78



SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 79



OCEANA COUNTY, MICHIGAN NO. 79

SOIL MAP OF OCEANA COUNTY, MICHIGAN — SHEET NUMBER 80